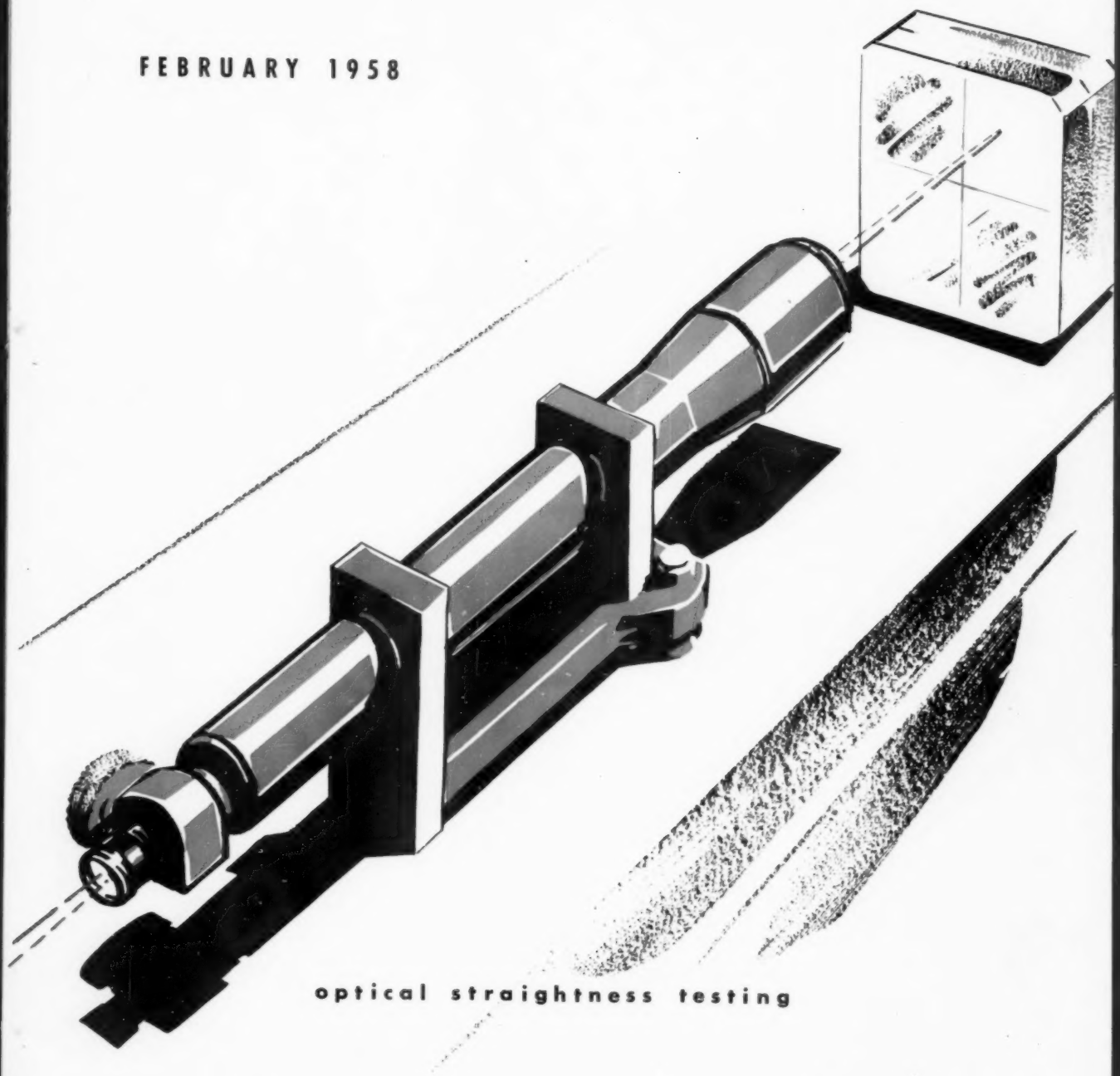
the

TOOL ENGINEER

FEBRUARY 1958



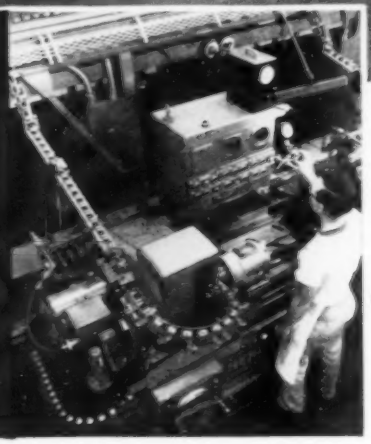
optical straightness testing

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

Over 70 Heald Internals precision grind

60 MILLION

Bearing Races a Year at The Timken Company's "AUTOMATIC FACTORY"



These two rows of Heald Model 190 Centri-Matics, on lines four and five of the Cone Finishing Department at Bucyrus, grind bearing cone bores to a tolerance of .0005. Cycle time ranges from 14 to 25 seconds, depending on size and stock removal.

Close-up view of one of the 29 Model 190 Centri-Matics showing conveyorized workhandling equipment. The parts come to the inclined loading chutes from the conveyor belt at top left. As the cones leave the machine through the unloading chute they are demagnetized. The sizing gage on top of machine permits quick checking of tolerances.

From raw tube stock to precision-finished bearing races, untouched by human hands! This—the ultimate in automation—has been successfully achieved at the Bucyrus, Ohio, plant of The Timken Roller Bearing Company. Here, a total of 60 million cups and cones a year are rolling off of America's most fully automated production lines. Sixty million individual bearing races—formed, heat treated, machined and sized in one continuous, fully automatic cycle.

The I.D.s of all races are finish ground on Heald Centerless Internals—43 No. 10 machines for tapered bores of outer races and 29 Model 190 Centri-Matics for straight bores of inner races. These are *standard machines*, fully automatic in loading, cycling and unloading. Hence they were integrated into the automated production line simply by the application of suitable conveyorized workhandling equipment.

For complete information on these or any other internal or rotary surface grinders, just get in touch with your Heald engineer.

HEALD®

IT PAYS TO COME TO HEALD!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

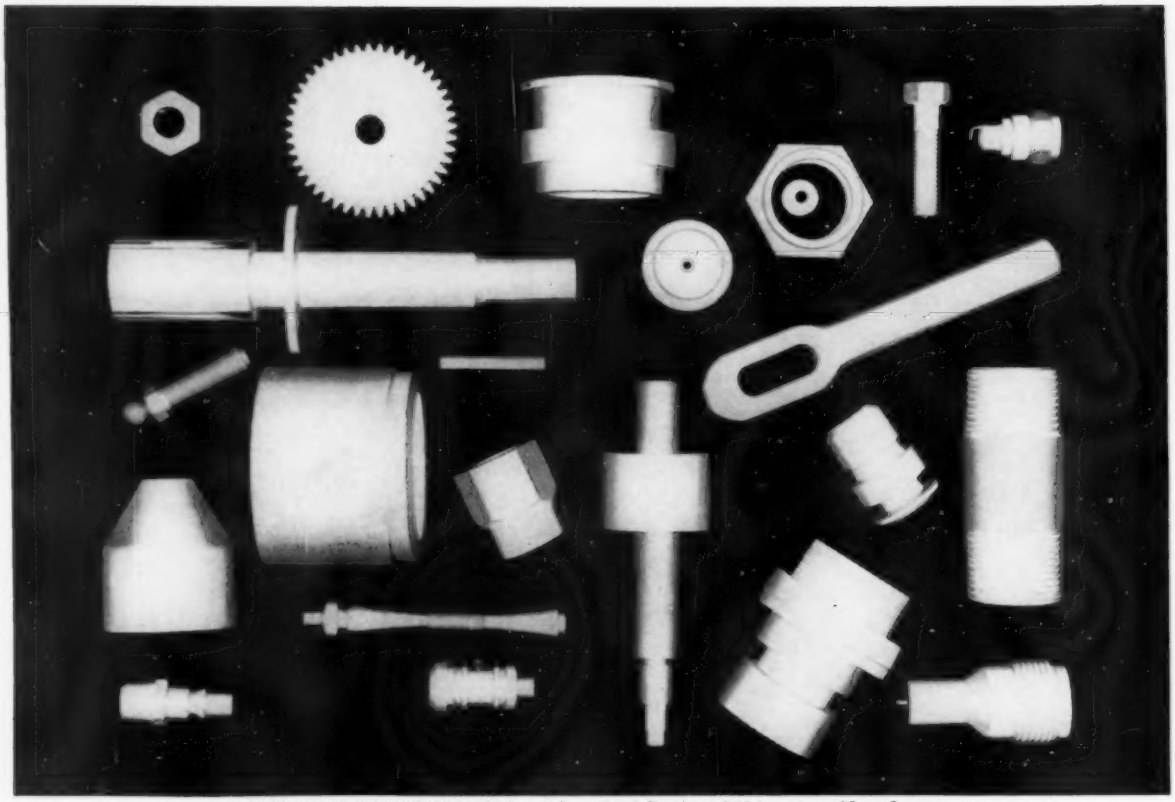
the tool engineer

February 1958 Vol. 40, No. 2

THIS MONTH'S COVER

Autocollimation is used for checking the flatness of surface plates and straightedges, and for measuring angles. This optical checking method eliminates inaccuracies associated with physical reference objects. Details are given in an article starting on page 83.

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and *Industrial Arts Index*



ONE OIL, MANY METALS. Moderately priced Sunicut 5534 gave uniformly excellent results in the machining of this wide variety of top-quality steel parts.

Designed especially for job shops...

NEW SUNICUT 5534 CAN BE USED ON A WIDE VARIETY OF STEELS

SUNICUT® 5534 ends your search for a single cutting oil that can assure quality machining of a wide variety of ferrous metals...ranging from B1112 to 4130 and including free-machining stainless steels.

A non-emulsifying, transparent cutting oil, Sunicut 5534 can speed production of general screw machine and turret lathe work. It gives excellent finish in tapping, drilling, threading, and light stamping operations and can be used on many special jobs run at both high and low speeds.

Try moderately-priced Sunicut 5534. It can save you money by reducing your cutting oil inventories and oil change time. It can boost your production and profits.

For detailed information, prices and delivery data about this new, versatile cutting oil, call your Sun representative today. Or write directly to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. TE-2.

SUNOCO®

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Smugness Is Dangerous

Nationally, we are wont to be satisfied with ourselves. We know we have everything of the best and that we can do anything better than anybody else. This attitude of smugness soon becomes static and the incentives to grow become numbed. Complacency sets in.

We are satisfied with our language while those abroad study ours and become proficient with it. The same applies to our achievements, developments and even culture. We do not read current foreign literature but ours is read avidly. In fact, recent surveys have disclosed that little interest exists in this country with respect to foreign periodicals. To understand others requires too much effort.

There is no need for this static state of affairs. To stand still is the same as moving backward. This is obvious because some people are always progressing forward. To remain the best requires constant effort.

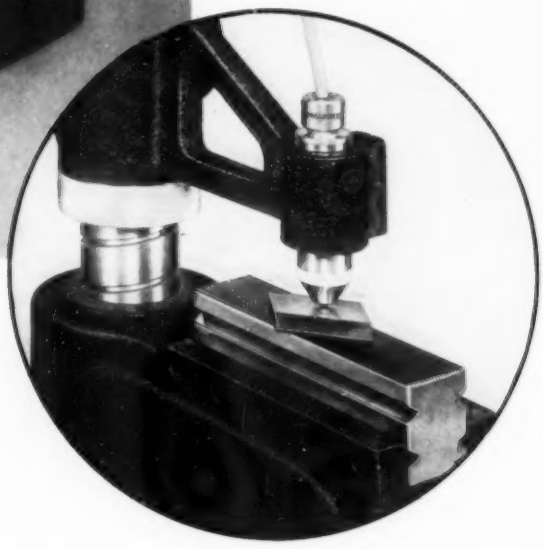
We cannot afford the luxury of complacency. The insidious dangers of smugness are not the effects of complacency alone. When one realizes that others have surpassed him, he may panic. Russian achievements and the reality of Sputnik have disclosed this sense of panic. Instead of senseless and ineffective panic, why not face reality? All developments, either at home or abroad, should be evaluated realistically. From this evaluation useful information may be drawn. That which is practical and serviceable should be applied immediately. That which is not may be catalogued for ready reference.

Part of growing up involves the ability to learn from others and build upon their experience. That is the foundation of engineering and has been proved in practice. The remedy for smugness is humility. May engineers never be guilty of complacency!

John W Greve

EDITOR

NOW! ON-THE-JOB GAGING with ACCURACY TO .00002"



THREADWELL DUAL RANGE S. I. ELECTRONIC COMPARATOR

New portable unit for on-the-job gaging and comparing now available from Threadwell at an amazing low price. Only the Threadwell S.I. Electronic Comparator has all these features:

- Two ranges selected by a simple turn of the control knob
- Coarse range 200:1, fine range 2000:1
- Lifetime steel tipped gaging unit
- Perfect repetition not found in units costing much more
- Operating pressure of less than 3 ounces
- Work is slid under the gaging head tip
- No sensitivity to temperature change; allows use in any part of plant or shop
- Interchangeable tips for various applications
- Flexible zero adjustment on the most sensitive range. Gaging head can be set up in a simple split clamp without need for fine mechanical adjustment.

Threadwell

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Greenfield, Mass., U.S.A.

Write now for complete information on this amazing instrument or see your Threadwell Distributor.

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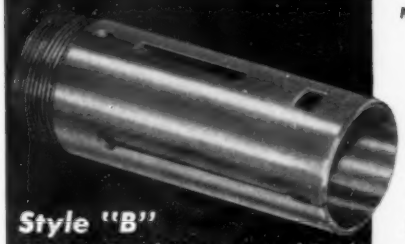
STANDARD EQUIPMENT in Progressive Screw Machine Plants

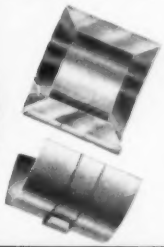
The Only MASTER COLLET
With No Work Pressure on the Screw.

Style "S"
Master Collets and Pads

Pads Interchangeable
Among Different
Makes of Automatics

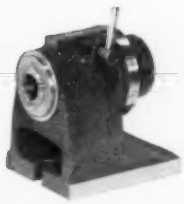


Style "B"
Master Feed Fingers and Pads

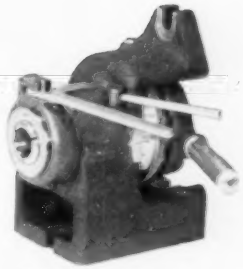


HARDINGE BROTHERS, INC., Elmira, N. Y.

Write for Style "S" Bulletin and Style "B" Bulletin



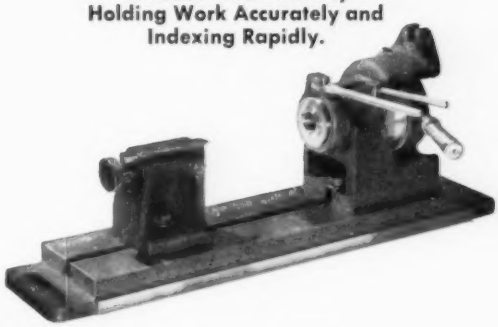
H-4 Tool Room-Inspection



HV-4 Production

HARDINGE COLLET INDEX FIXTURES

Increase Production by
Holding Work Accurately and
Indexing Rapidly.

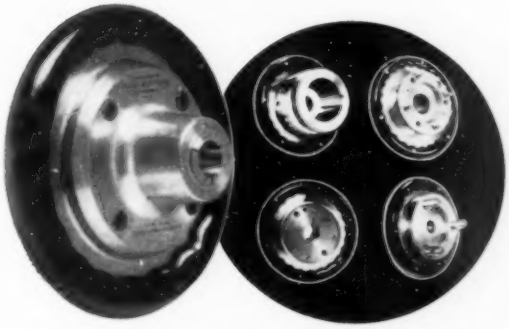


HARDINGE BROTHERS, INC., Elmira, N. Y.

Write for Bulletin CF5

HARDINGE-SJOGREN Speed COLLET CHUCKS

Fast — Accurate
Increase Production Capacity



Available in 1 1/16"; 1 3/8"; 2 1/4"; and 3 1/2" collet capacity. Threaded nose, cam lock, tapered key-drive and American Standard spindles. *Write for Bulletin SA.*

HARDINGE BROTHERS, INC., Elmira, N. Y.

HARDINGE
ELMIRA, N.Y.

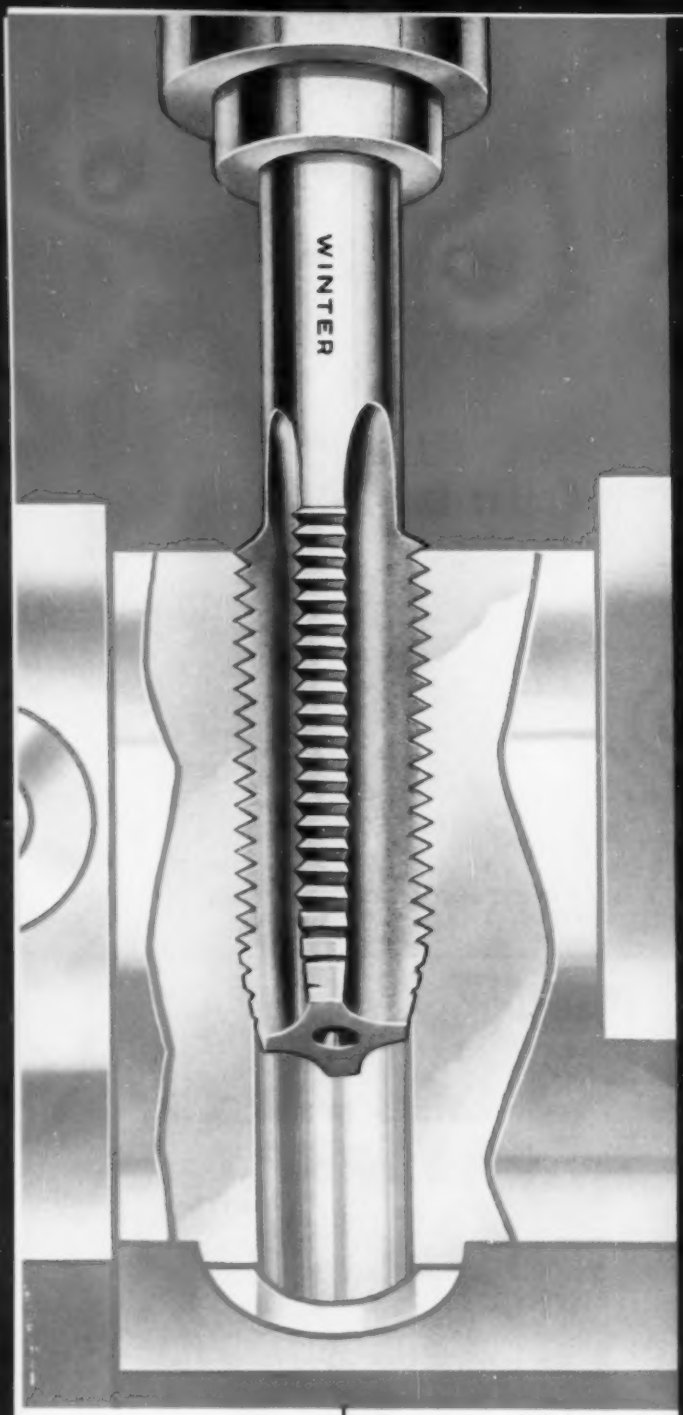
COLLETS for LATHES and MILLERS

ACCURACY — DURABILITY — LOW COST

Write for Bulletin 56 — Complete collet ordering information for all Lathes, Millers, Grinders and Fixtures

HARDINGE BROTHERS, INC., Elmira, N. Y.

Immediate stock delivery from Atlanta, Boston, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, Minneapolis, New York, Oakland, Philadelphia, San Francisco, St. Louis.



To satisfy your higher standards of today — *and of tomorrow* — Balanced Action tapping

The tempo of production is speeded up. You call on your machines, and on your tools, to meet new standards of volume-plus-accuracy.

More than ever before, then, it pays to use the taps designed and built to operate with Balanced Action. *All Winter taps, both standard and special, are Balanced Action taps.*

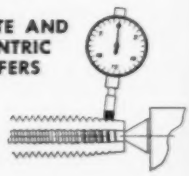
CALL YOUR DISTRIBUTOR for standard and special WINTER Balanced Action Taps, Dies, and Gages.

EXACT FLUTE SPACING

UNIFORMITY OF FLUTE CONTOURS

PRECISION CHIP DRIVER CONTOURS

ACCURATE AND CONCENTRIC CHAMFERS



WINTER

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles • Division of National Twist Drill & Tool Co.

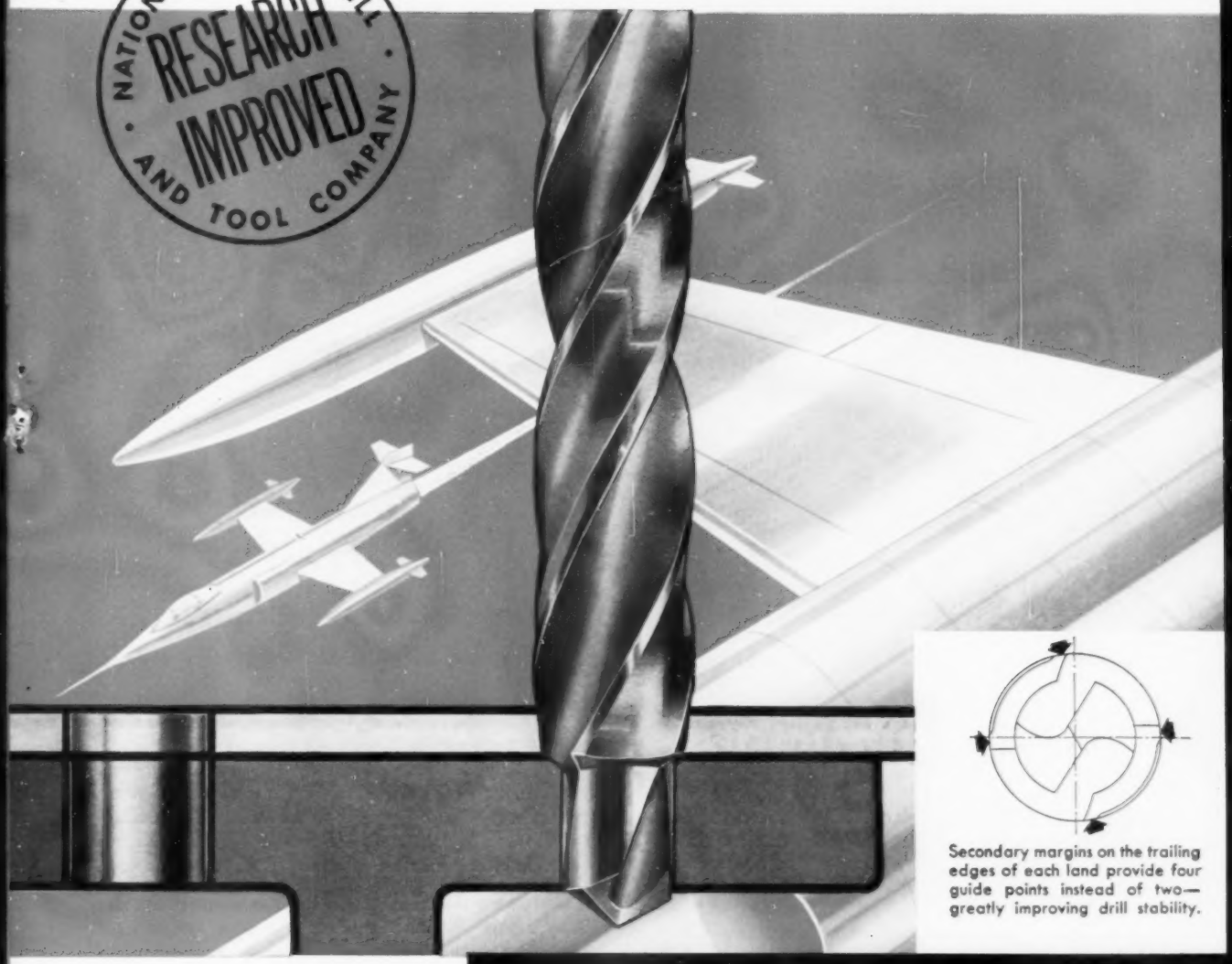
"Research Improved" means *modern* metal cutting

A typical example of cost-cutting brought about by a National "Research Improved" design:

Production of accurate holes, in terms of size, roundness and straightness, is now being obtained in many applications with National Double Margin Step Drills. Guiding, roughing and finishing—requiring two or three steps with conventional tools—becomes a single operation.

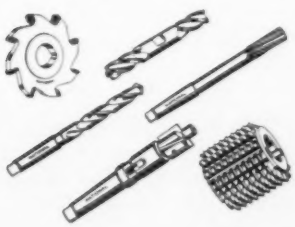
They perform accurately where guide bushings cannot be used (as shown below)—are very successful for portable drilling.

NATIONAL TWIST DRILL AND TOOL COMPANY
RESEARCH IMPROVED



Secondary margins on the trailing edges of each land provide four guide points instead of two—greatly improving drill stability.

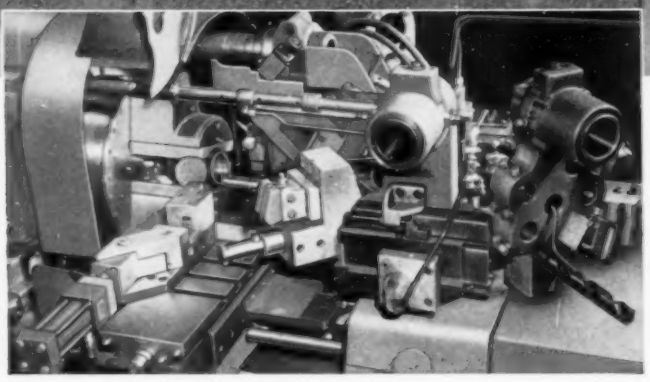
CALL YOUR DISTRIBUTOR for NATIONAL twist drills, reamers, counterbores, milling cutters, end mills, hobs, carbide and special tools.



National

NATIONAL TWIST DRILL AND TOOL COMPANY
Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York
Detroit • Chicago • Dallas • San Francisco • Los Angeles



Edward Valves Div. cuts setup time on valve bodies

Takes advantage of electric setup control panel, octagonal turret, JETracer on Gisholt Fastermatic

You may spot production ideas in the way Edward Valves Division of Rockwell Manufacturing Company, East Chicago, Indiana, is increasing production of 1½" steel Univalve bodies.

A new Gisholt MASTERLINE 2F Fastermatic Automatic Turret Lathe is doing the job. With the Fastermatic's electric setup control panel, the operator preselects all important machine functions—including low spindle speeds for forming and threading, and high speeds for other operations. And with the Gisholt JETracer slide tool mounted on an 8-sided turret, a maximum number of surfaces are machined in a single chucking—with greater accuracy, finer finish and with more consistent quality.

Parts are held in an 18" 2-jaw hydraulically operated chuck. Automatic positioning at the end of each cycle speeds loading and unloading. Once the automatic cycle starts, turret tools drill, turn, face, form, relieve, chamfer, bore and thread. Cross slide tools face and chamfer. Critical internal diameters are finished to a high degree of accuracy, using turret-mounted JETracer slide tool.

Like to hear the facts on how the Fastermatic lets you utilize smart tooling...eliminate human errors...get record production on long runs, automatic cycle operating advantages on short runs? Contact your Gisholt Representative. He has the facts, and his wide experience may suggest new methods to improve your profit picture.

MASTERLINE GISHOLT SINCE 1887 GISHOLT

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin, U.S.A.

WRITE GISHOLT TODAY for advance data on the new Gisholt MASTERLINE Fastermatic Automatic Turret Lathe. Ask for Bulletin No. 1179.

ASK YOUR GISHOLT REPRESENTATIVE ABOUT GISHOLT FACTORY REBUILT MACHINES WITH NEW MACHINE GUARANTEE

Guard removed for photographic purposes

Production rate climbed sharply when the new "81-Coat" abrasive belts were used for this job. It's removing the gates from sand-cast aluminum parts used in the automatic feeder of a punch press. A 24-X 81-Coat Resinall Metalite Belt was found best, with lubrication by light grease stick. The same advantages of increased production, and longer life, are found with discs as well as belts . . . on stainless steel, brass, and other metals.

Faster stock removal with new abrasive belts

New "81-Coat" abrasive belts with Spur Action have rougher, tougher cutting points for faster stock removal . . . stronger resin bond for greater heat endurance. Try them on *your* production problem—at your plant or at one of our 17 Abrasive Tech Methods Rooms: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, Teterboro, Camden, San Francisco, Seattle, St. Louis, and Brantford, Canada. Main Office and plant: Troy, N.Y. For Export, Norton Behr-Manning Overseas, Inc., Troy, N.Y., U.S.A.

BEHR-MANNING CO.

TROY, N.Y.

A DIVISION OF NORTON COMPANY NORTON ABRASIVES

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes
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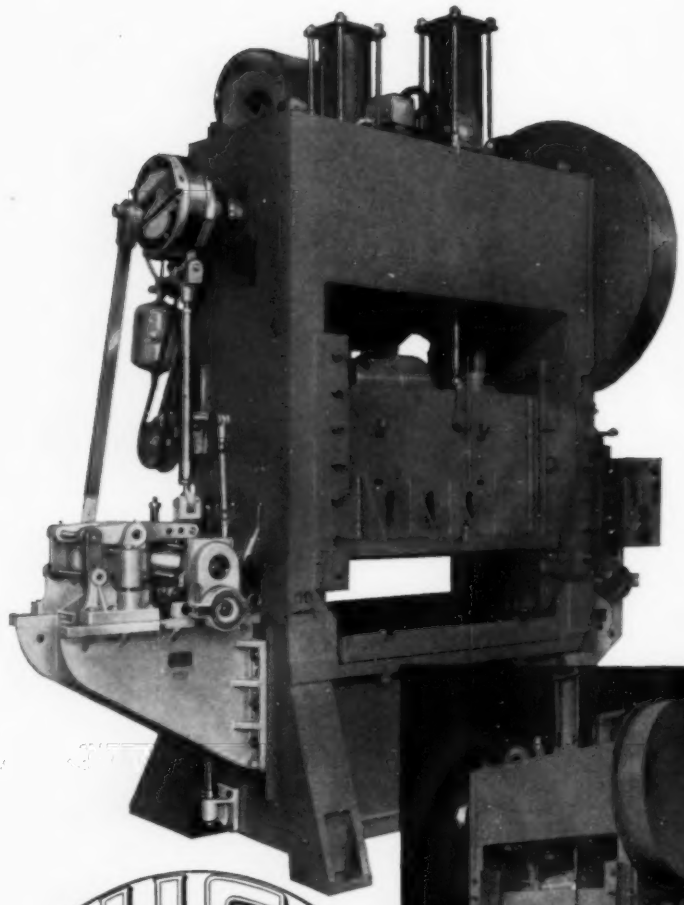
BEHR-MANNING®

FOR CONSISTENT PERFORMANCE

U. S. Style "B" Roll Feeds

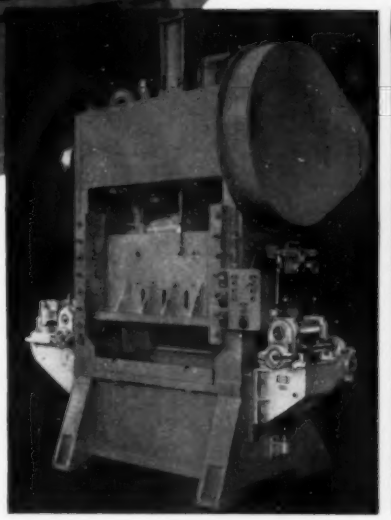


The introduction of U. S. Tool Company Style "B" Roll Feeds brings to your Press-Room a new line of Rack and Pinion Roll Feeds in a range of sizes to keep pace with most production requirements.

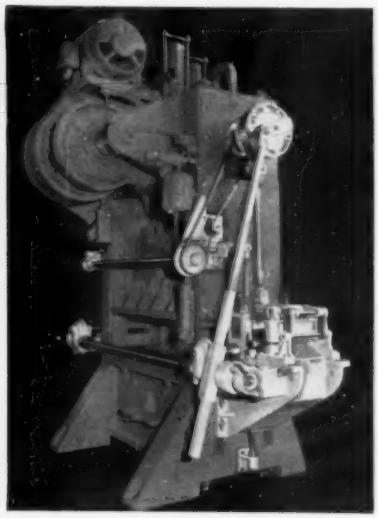
U. S. Style "B" Roll Feeds are made in both double and single types, with bolster plate for O.B.I. presses or with adjustable mounting brackets for straight side presses.

All Style "B" Roll Feeds are equipped with hardened and ground rolls of hollow construction, which are driven by hardened spiral gears running in oil. These gears are mounted in an enclosed housing. The roll-pin type over-running clutch has carbide inserts. Standard equipment also includes manual roll lifters; self-equalizing brakes; two-piece adjustable driving eccentric to simplify timing the feed in relation to the motion of the ram of the press; stock oiler and eccentric operated scrap chopper. Automatic roll lifters are available in either ram operated or adjustable eccentric operated types.

For full information regarding the U. S. Style "B" Roll Feeds write for your copy of Bulletin 85-T.



U. S. Style "B" double Roll Feed Model No. RF-1212, with scrap chopper mounted on a modern straight side press. This particular installation handles stock widths up to 12", with feed length adaptable up to 12".



Rear View: Showing the rack and pinion mechanism and cross members for actuating the entering feed and eccentric operated roll lifters. One of 5 models of U. S. Style "B" Roll Feeds will fit your Press Room Eqiupment.

PRODUCTS

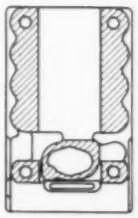
Slide Feeds
Roll Feeds
Stock Straighteners
Stock Reels
Stock Oilers
Coil Cradles
Wire Straighteners
Die Sets
Multi-Slides®
Multi-Millers®

U. S. TOOL COMPANY, INC.

AMPERE *(East Orange)* NEW JERSEY

Big Cincinnati Hydro-Broach

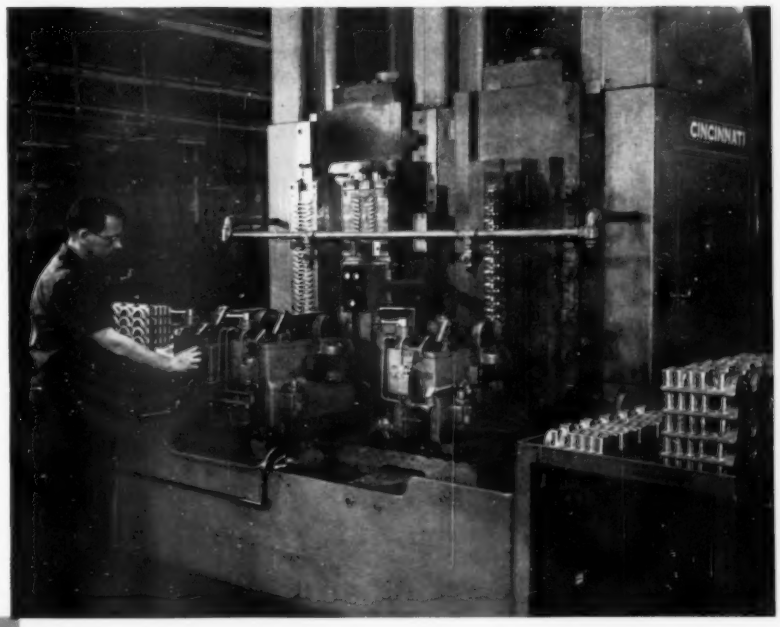
Exerts 25 Tons Push To Broach Bearing Cap Clusters

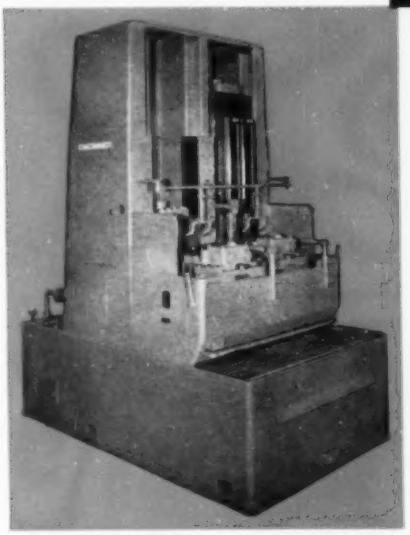


Drawing of part showing surfaces broached

Production data:

Part name . . . Bearing cap cluster
Material . . . . Cast iron
Operation . . . Broach half bore, joint face, bolt bosses, oil pump pad, edges and chamfers
Machine . . . . CINCINNATI® No. 25-66 Duplex Vertical Hydro-Broach
Production . . . 70 per hour at 80% efficiency





CINCINNATI No. 25-66 Duplex Vertical Hydro-Broach Machine. Brief details will be found in Sweet's Machine Tool File.

Cincinnati builds them taller, but the Hydro-Broach illustrated here is no midget . . . it has 66" stroke and 25 tons push! That's a lot of vertical broaching capacity for any machine. ¶This equipment is a complete production package, with tooling by Cincinnati Application Engineers to broach bearing cap clusters. The work progresses through three stations, from right to left. Right-hand fixture is a single station unit, and holds one casting for broaching the half bore. Left-hand fixture has two stations; one for broaching the joint face, edges and chamfers, and in the second station, bolt bosses and oil pump pad are broached.

To relieve the operator of unnecessary physical effort, both fixtures are hydraulically operated. Production averages 70 bearing cap clusters per hour at 80% efficiency.

CINCINNATI Broaching Machines and engineering service are tops in the machine tool industry. Chances are they can reduce the cost of your external surface machining operations. Give us complete details and our engineers will go to work on the job.

Special Machine Tool Division

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CINCINNATI

CINCINNATI® Special Machine Tools and Complete Production Lines

new Fairchild F-27 have the "mettle in their

First American propjet transport designed for short and medium-range operators . . . both airline and corporate . . . the new F-27 is the proven successor to the famed DC-3.

From design to production, the best brains and equipment in the aircraft industry have been employed for 5 years in the development of this new plane. So it follows that Morse Cutting Tools . . . particularly Morse Aircraft Drills and Router Bits . . . were used in construction. Because it *takes* quality to *make* quality . . . and the mettle of Morse Tools is a *known quantity.*

Likewise, on *your* own cutting tool needs, it pays to mark your orders "Morse". Let your Morse-Franchised Distributor show you exactly why. Call him today.

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS
A division of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

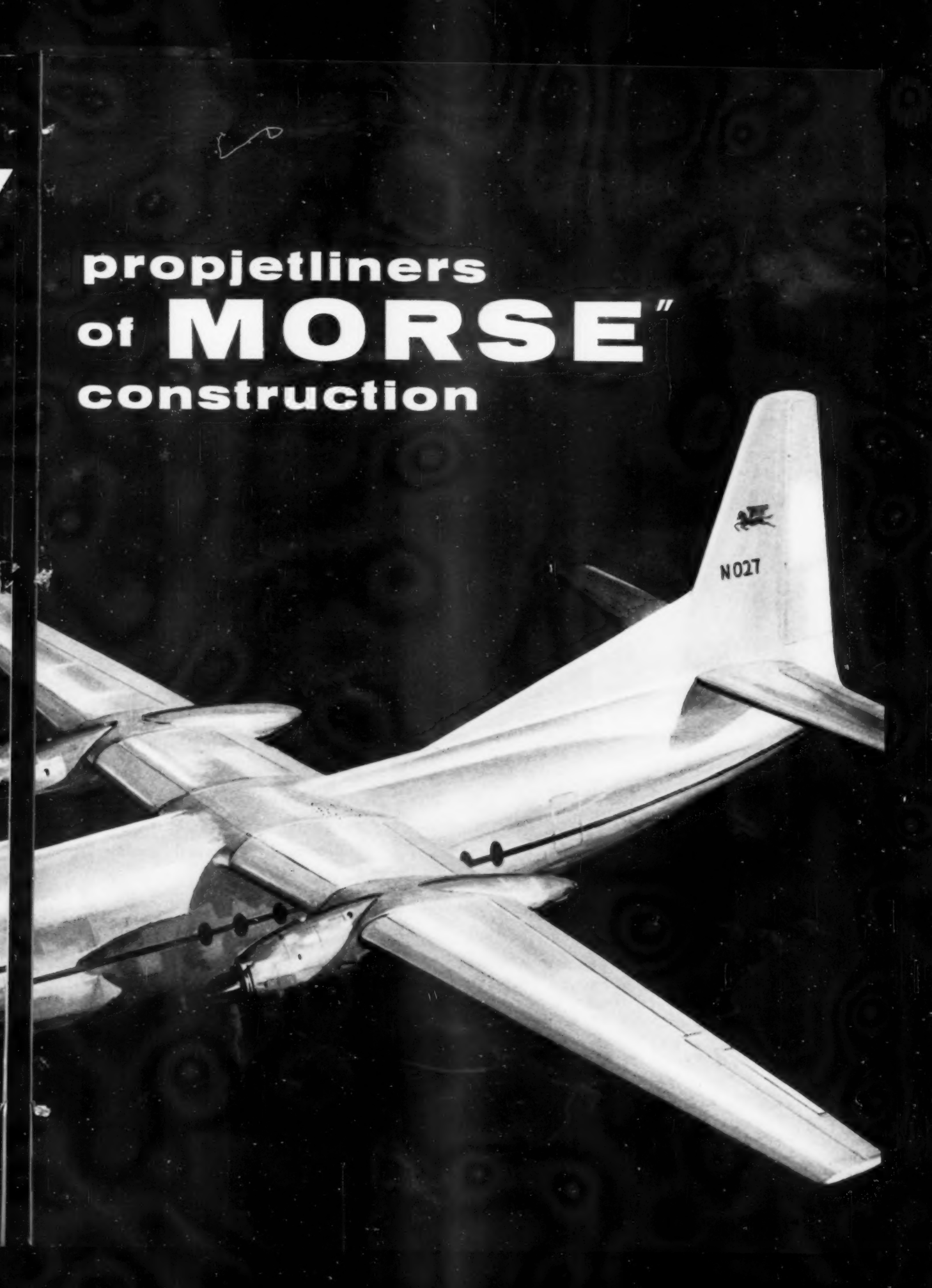
The F-27 is made in the USA by Fairchild Engine & Airplane Corp., Hagerstown, Md. Cruising speed, 280 mph. Range up to 2500 miles. Takeoff distance, 3680 ft.

. . . in Cutting Tools

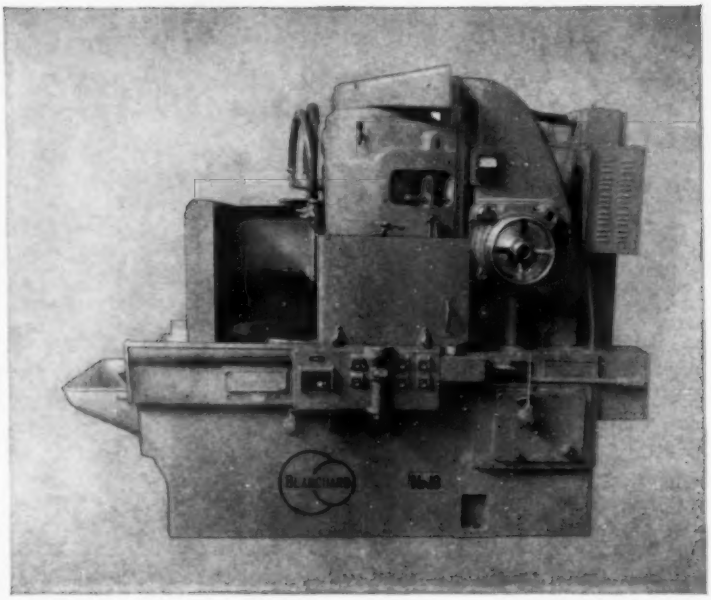
MORSE

means "THE MOST"

propjetliners of MORSE" construction



For best results from your Blanchard Surface Grinder



BLANCHARD NO. 10 SURFACE GRINDER

Use Blanchard Wheels!

Blanchard specializes in the manufacture of segments and cylinder wheels for Blanchard and other Vertical Spindle Surface Grinders. If you have a difficult grinding job, whatever the material may be, or if you are not satisfied with the results you are now getting, let us help you.

Blanchard wheels are the quality wheels for Blanchard Grinding. Use them to get maximum performance *from your Blanchard!*

PUT IT ON THE BLANCHARD

Please send me a free copy of "The Art of Blanchard Surface Grinding" (3rd Edition).

THE BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASSACHUSETTS

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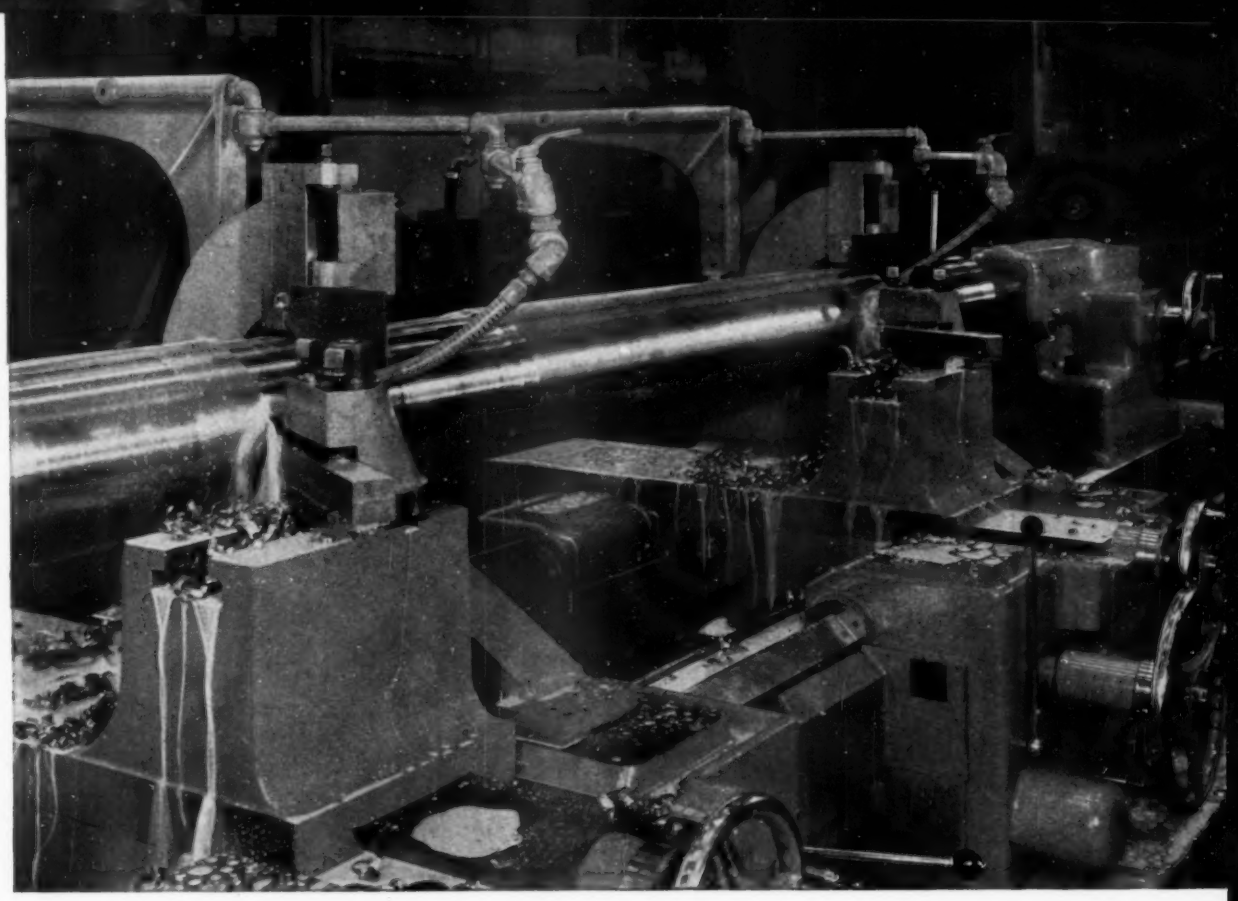
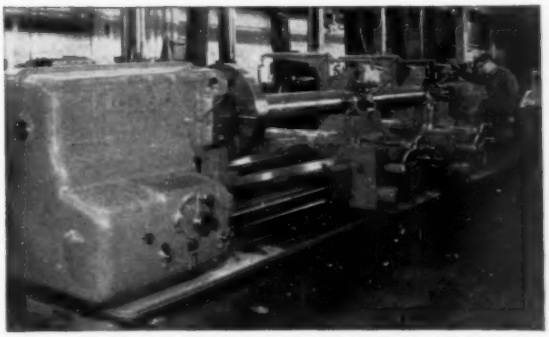


● *Cutting with two Carriages equipped with plain block rests and follow rests.*

MACHINING TITANIUM BILLETS



● *32 inch "American" Double Carriage Pacemaker Lathe.*

An extremely difficult job — a real challenge to the rigidity, stamina and "staying" qualities of any lathe.

Cutting titanium offers terrific resistance to the cutting tool which in turn demands maximum rigidity of the tool supporting members in order to hold vibration to the very minimum; otherwise chatter and high tool mortality are inevitable.

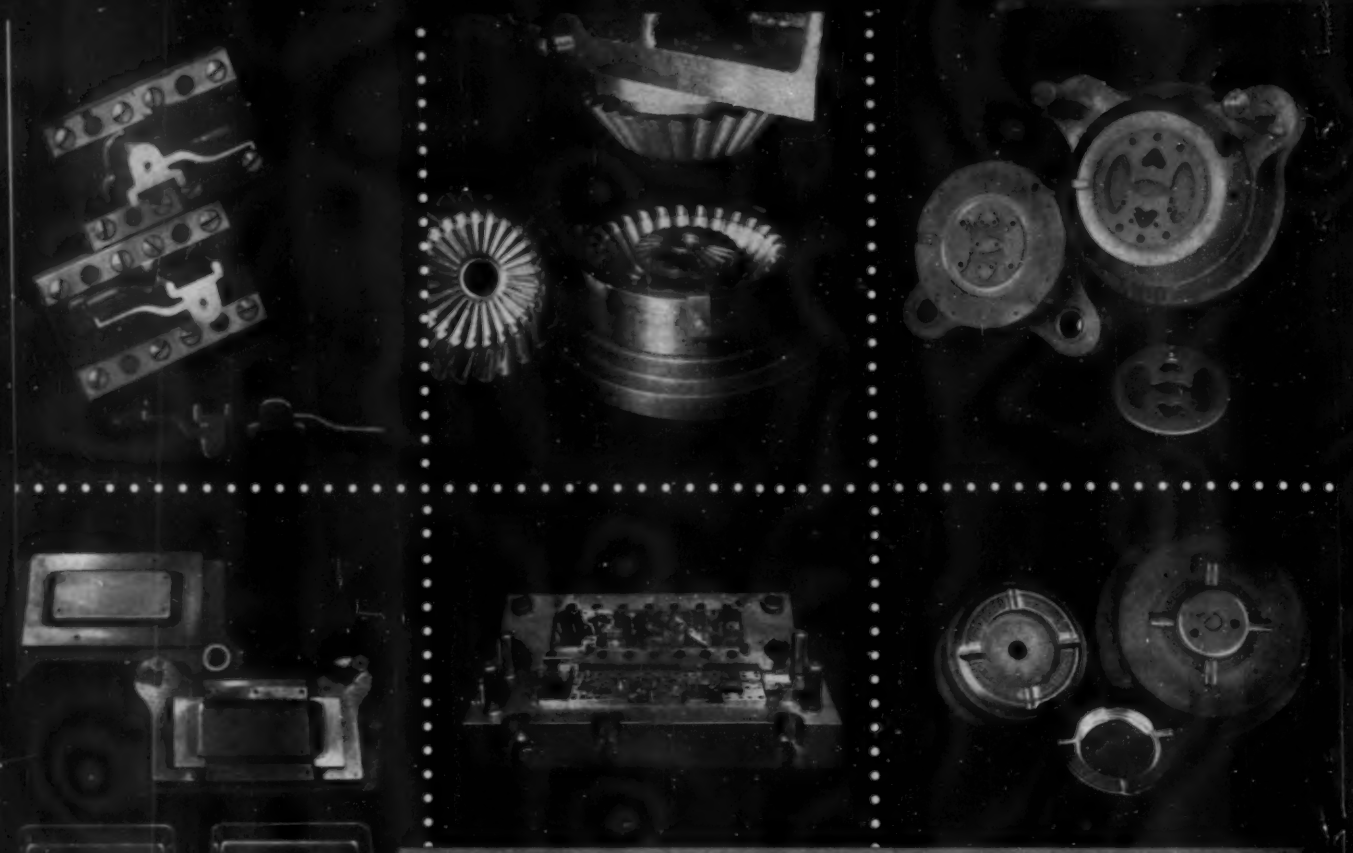
The fact that all of the major titanium fabricators are using "AMERICAN" Lathes, selected only after repeated demonstrations, is conclusive testimony to the power, stamina and rigidity of these machines.

There are exclusive features which definitely contribute to this result, such as the wide, four vee bed with walls rigidly tied together between the girths by an angular web which forms a chute for quick disposal of chips; replaceable hardened tool steel vees; solid 3-vee mounting of the carriage on the bed; powerful headstock with triple bearing spindle and bearing adjustment from the outside and others which space limitations prevent mentioning.

For a complete description of all of these features just send for bulletin No. 144.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS



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for every job in the shop

COLONIAL NO. 6—Non-Shrinkable is a general purpose die steel worth having in stock at all times. It pays off in reliable performance on the widest variety of jobs. It pays off in simplified inventory—you can carry *one* steel in the sizes you usually require, because you can make almost anything with Colonial No. 6. Do you have full data on this easy-machining, safe hardening, simple to heat treat die steel? Write us for Colonial No. 6 facts you can use, and the direct help of a trained Vanadium-Alloys sales engineer.

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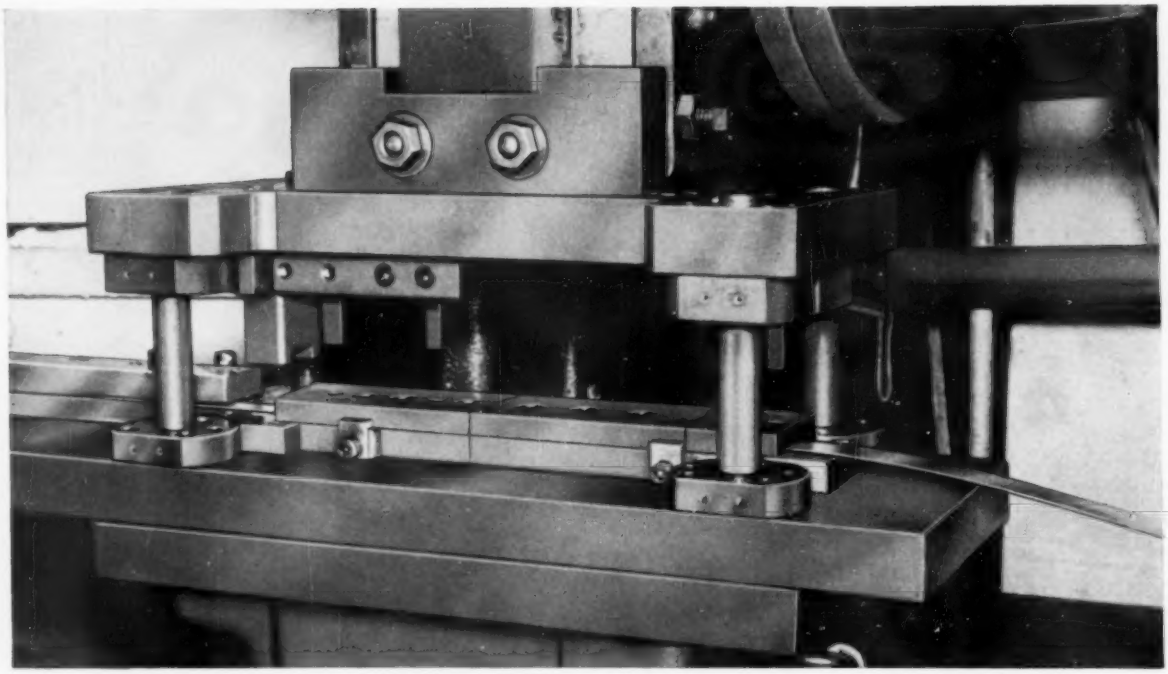

"Tri-Mo" punching and cut-off die used by Warner Mfg. Corp. to form Stainless Steel window tracks

No Resharpening After 1½ Million Pieces With "Tri-Mo" Punching & Cut-Off Die

Warner "Weather-Master" combination window

UDDEHOLM Tool Steel Provides Long Run On Stainless Steel Parts

Here's a remarkable example of superior tool steel performance. Warner Mfg. Corp., of Elizabeth, N. J., uses Stainless Steel tracks .015" thick for their "Weather-Master" combination windows. A punching and cut-off die of Uddeholm's high-carbon, high-chrome "Tri-Mo" has been turning out these tracks at Warner for over two years *without resharpening*. During this period the die has made over 1,500,000 tracks *and is still being used*. Needless to say the people at Warner are pretty enthusiastic about Uddeholm's air hardening "Tri-Mo." An ideal tool steel for maximum production, it combines excellent non-deforming properties with good toughness and extremely high resistance to abrasion. It has met Warner's needs perfectly.

Such performance is typical of all Uddeholm's fine Swedish quality tool steels. And your Uddeholm representative is always ready to help you choose the one best suited to *your* job. Uddeholm's tool steel stocks include over 2800 combinations of size, shape, grade and finish—one for *every* individual requirement. Delivery is fast and dependable.

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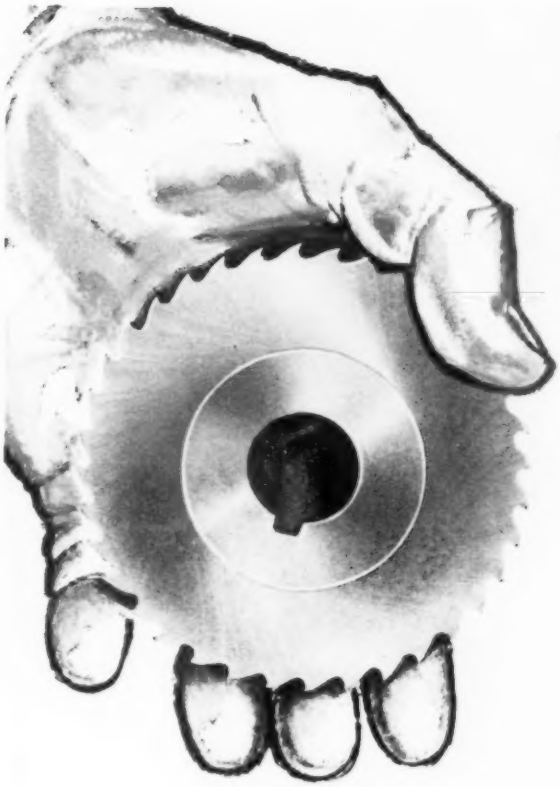

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REGARDLESS of the type or size of circular saw you require, there's a Motch & Merryweather blade to do the job . . . *better and faster.*

M&M's specially-developed Triple Chip tooth design distributes cutting strain, permits heavier feeds at higher speeds, greatly prolongs the life of each blade.

Your local M&M dealer stocks the complete line of Motch & Merryweather cut-off, slitting and slotting saws. In addition, he is always ready—with the help of M&M's Engineering Department—to assist you in solving unusually difficult sawing problems. Call him today.

FREE—*Send today for your copy of M&M's Circular Sawing Handbook, a pocket-sized guide to sawing operations.*

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MOTCH AND MERRYWEATHER

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Punch Answers for Piercing Problems

On many punching operations, close center to center hole spacing in work and extremely fine tolerances must be held. R-B makes special retainer plates that will hold punches and die buttons exactly to your spacing specifications.

Any shape, size or number of punches and die buttons can be incorporated in the designing of your special R-B retainer plates. Also, ball locks are built into each special retainer to provide the same quick radial and vertical locking of punches and die buttons found in standard R-B retainers.

Special R-B retainer plates are made of tool steel which is precision ground after hardening. You will save skilled man hours in die construction and maintenance by using these multiple hole retainer plates. Result—more work completed each day and increased profits for you.

Use R-B Engineering Service for your Piercing Problems

For Additional Information or Engineering Service, Write to:

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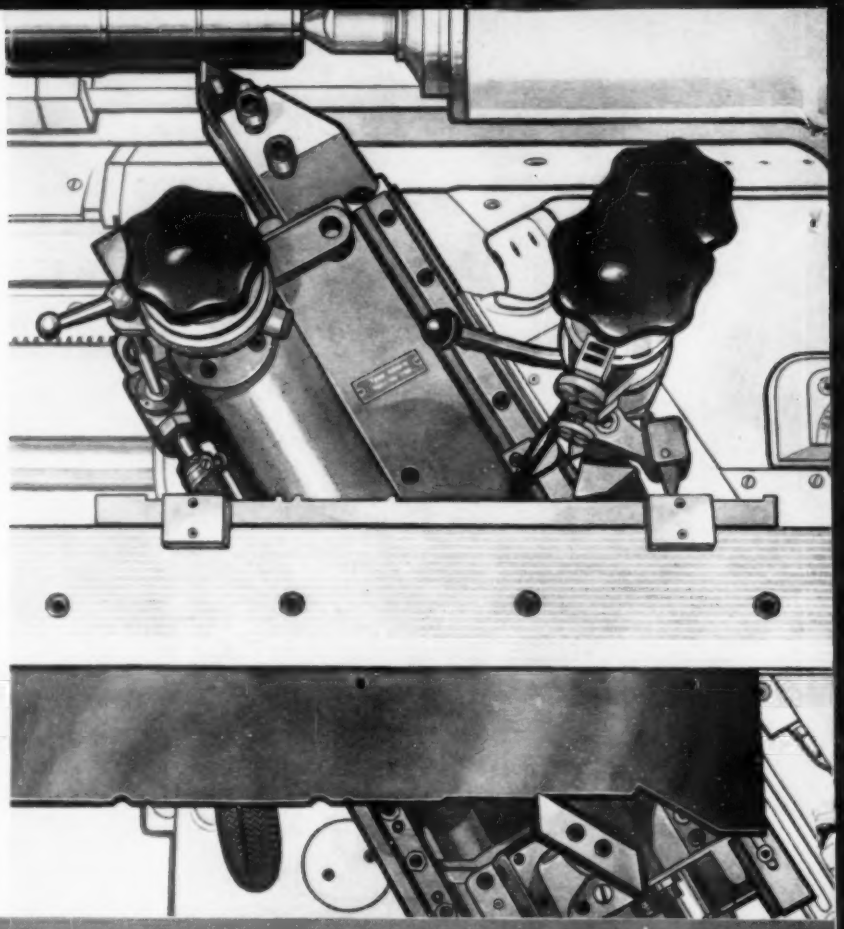
How to find a better heat-treating method

Here's a sound way to do it. Take your problems to the people who have consistently, over the years, provided the metal treating industry with new and better ideas, more efficient, more practical equipment. This will bring you to Lindberg, creators of the famous Cyclone type atmosphere furnaces, the long-life "dimple" vertical radiant tube, the revolutionary new CORRTHERM electric heating element and so many other innovations in better heat treating methods. Lindberg is synonymous with heat treating furnaces. We build them for carbonitriding, carburizing, hardening, tempering, normalizing, bright stainless annealing, brazing, carbon correction, nitriding, or any other metal treating requirement. Give your production processes the advantages of Lindberg's forward look in "heat for industry" techniques. Get in touch with your nearest Lindberg Field Representative (See classified phone book) or write Heat Treating Furnace Division, Lindberg Engineering Company, 2447 W. Hubbard St., Chicago 12, Illinois.

LINDBERG **heat for industry**

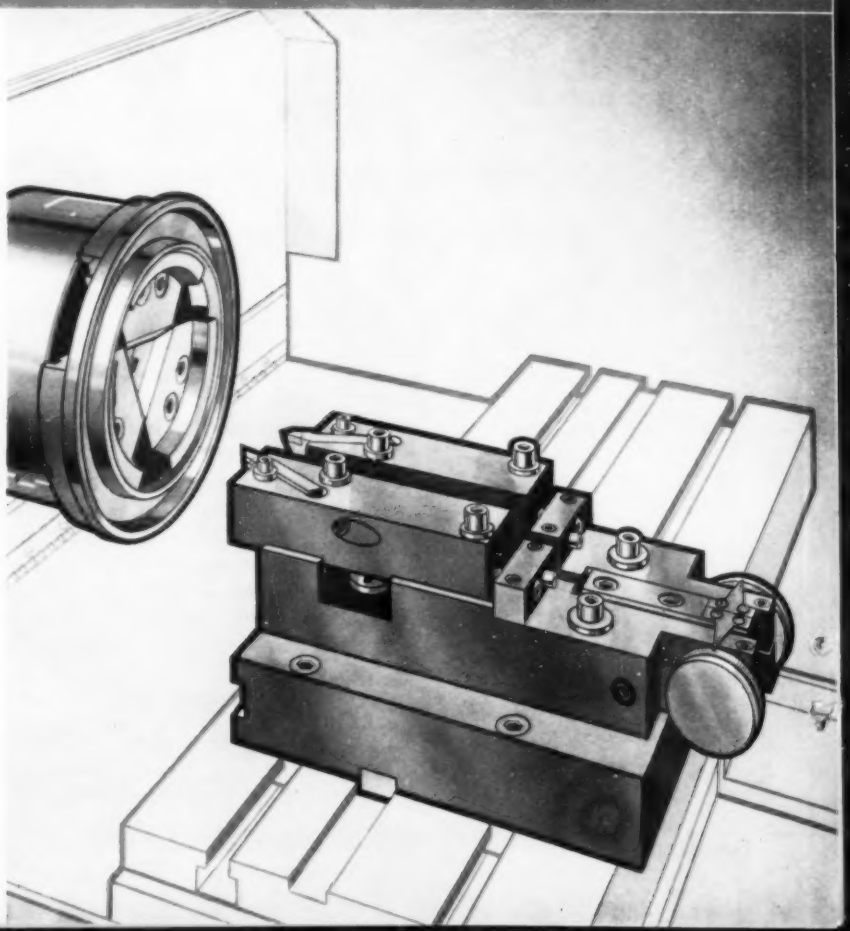
Look at
Single Point Tooling on
New Britain +GF+

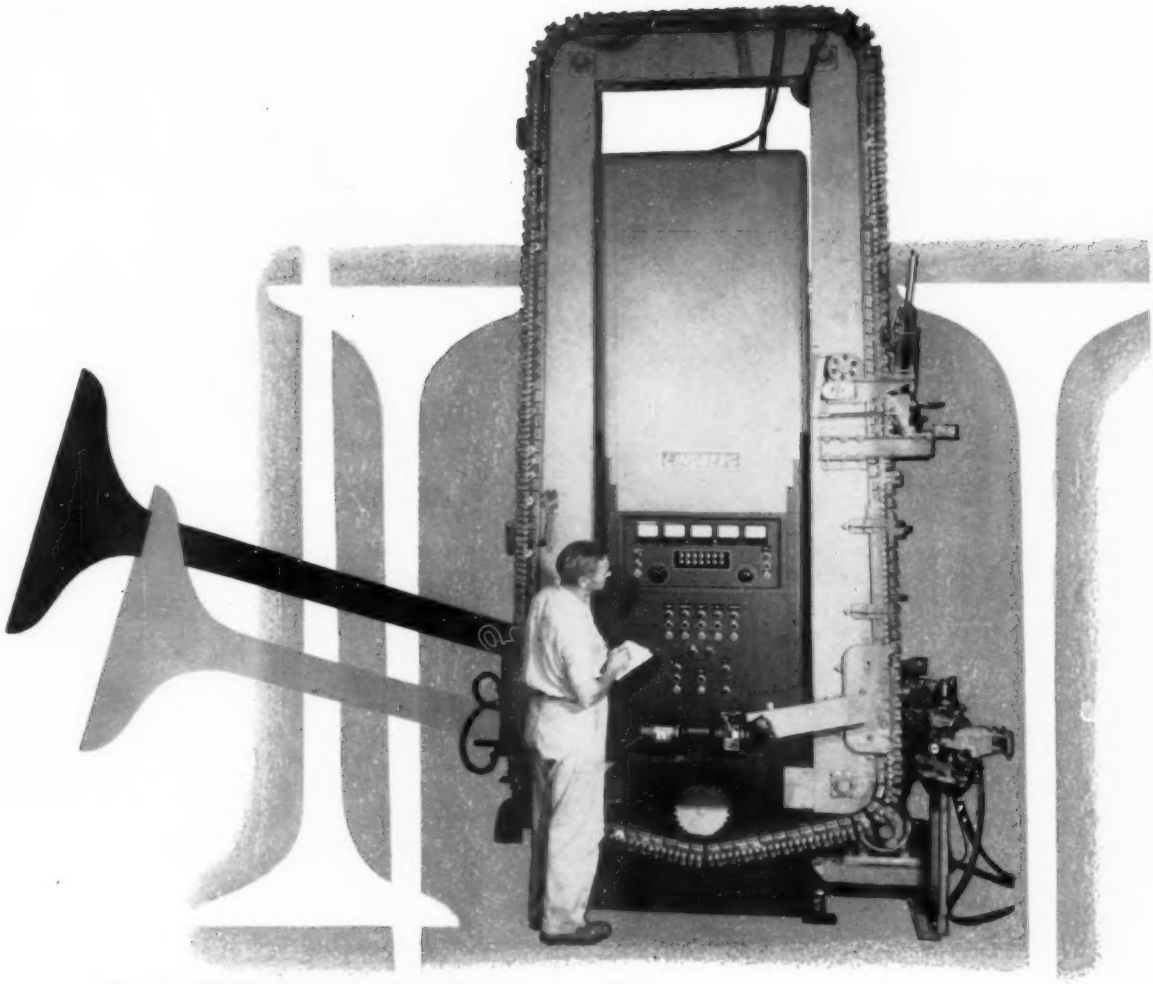
Outproduces gang tooling setups by reducing tool change time practically to zero, and by cutting at maximum speeds and feeds for tool efficiency.



Look at New Britain's
simple approach to problem pieces

Low cost per piece is inherent in New Britain Precision Boring Machines because of their simplicity, versatility, speed, repetitive accuracy and inexpensive tooling. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.





Lindberg pioneers in High Frequency Heating

Along with its pioneering in all phases of "heat for industry" Lindberg is one of the largest makers of High Frequency heating units. Our "H-F" designers and engineers have made outstanding developments in this important heat treating field. For example, we illustrate a remarkable unit just recently completed for aluminizing automotive valves. It was designed vertically, saving 60% of floor space, and is completely automatic. No operator is required. It fits perfectly into an automated production line.

Our High Frequency Division provides units for hardening, brazing, heating for forging and forming, annealing and many other processes, and designs a variety of fixtures for application to "H-F" units. Lindberg also supplies a complete line of motor generators for all induction heating and melting applications. Get in touch with your nearest Lindberg Field Representative (See classified phone book) or write High Frequency Division, Lindberg Engineering Company, 2447 W. Hubbard St., Chicago 12, Illinois.

LINDBERG heat for industry

STRIPPIT *tooling versatility*

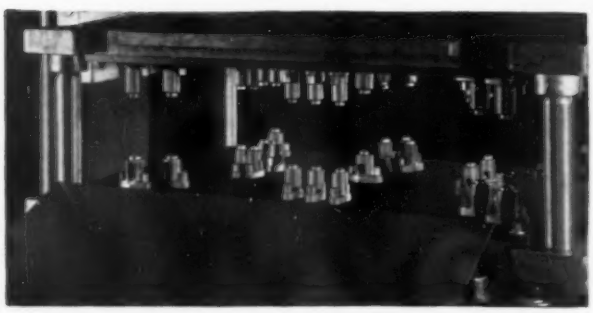
keeps presses working, not waiting!

Nothing to mount on the ram, nothing to align or adjust — just place your Strippit setup in the press and start the run.

That's how Strippit versatility pays off. Any good bench man can mount these independent self-contained punching and notching units in any template pattern within press capacity. New Strippit setups can be kept ready for the press, virtually eliminating down-time.

For flatwork, extrusions, structurals from the smallest gauge to 3/4" mild steel, Strippit gives you these extra advantages:

• The effect of quick-change dies without die-making or die-spotting • Speed over drilling — plus no de-burring • Units re-usable over and over • Readily removable punches and dies • Ease, accuracy of template mounting — pilot pin centered on punch • Each unit complete — permanently aligned, fully guided, self-stripping.



For unlimited feeding of work, Strippit Type CD and JD (heavy-duty) Punch and Die Assemblies are readily template-mounted to press ram and bed in any desired pattern.

Write today for all details and a demonstration by a Strippit mobile unit at your plant.

Special tools made up to your specifications.
Warehouse facilities in Chicago and Los Angeles.

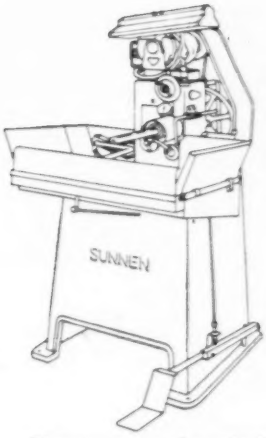
WALES STRIPPIT COMPANY
211 Buell Road, Akron, New York

One of a complete line of Strippit vertical and horizontal hole punching units in capacities from the lightest material to 3/4" mild steel. Wide choice of die heights, shut heights and throat depths.

Also, 90-degree Corner Notching Units in 3" x 3" and 5" x 5" sizes, plus V, Radii and many special shape notching units. Capacities to 1/8" in mild steel.

Manufactured in Canada by Strippit Tool & Machine Limited, Brampton, Ont.

HOW WOULD YOU PROCESS THIS TANDEM BORE JOB?



Diameter range of standard honing tools: 1/8" to 2 5/8".

The piece requires a .0002" hole tolerance plus perfect alignment, roundness and straightness of both holes.

The best process for this tough job was Sunnen Honing. The Sunnen Honing tool hones both holes simultaneously . . . the workpiece is self-aligning on the tool. The one honing operation guarantees alignment, identical size and controlled surface finish in both holes.

Sunnen Honing eliminates the problems you have in machining tandem bores by other methods: clamping distortion; jump and chatter of long quills or boring bars; turntable alignment error; inconsistent finish produced by dull tools.

Sunnen Honing easily holds tolerances to .0001" . . . requires no fixtures and assures low cost per part. Average honing machine installation with tooling is around $1,000.

send for five informative

honing booklets

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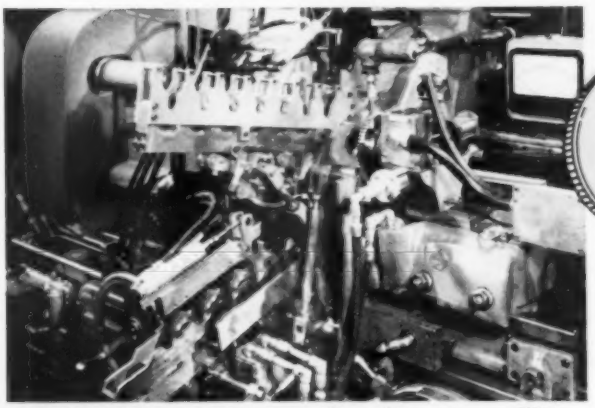
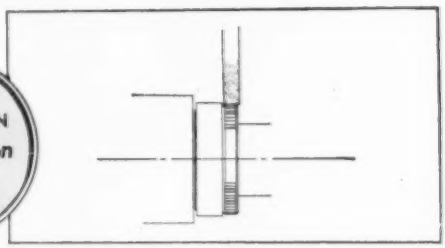
The more you grind the more you save with Norton...

cost-cutting automatic operations

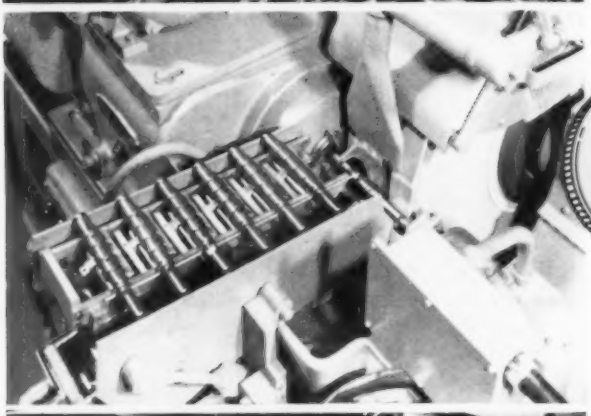
Typical automatic features on Norton grinders



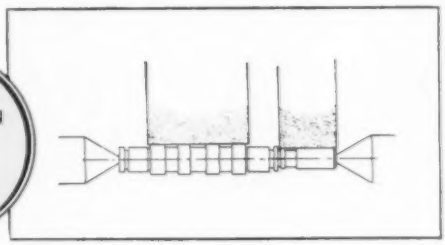
SAVINGS ON *Transmission Gears*



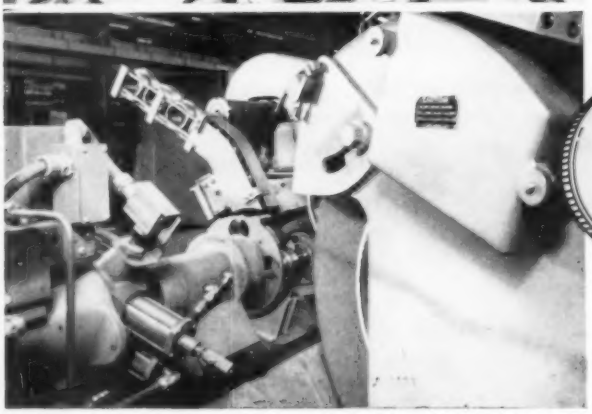
In a Type CTU Cylindrical Grinder arranged for completely automatic loading, grinding, and unloading of transmission gears, the part is held on a chuck and grinding cycle is terminated by an automatic air-electric grinding gage that signals when work is to size.



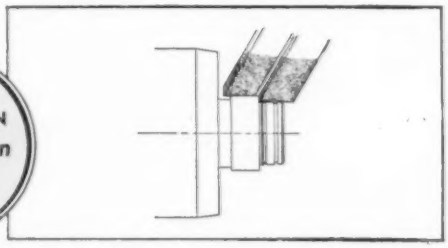
SAVINGS ON *Valve Pistons*



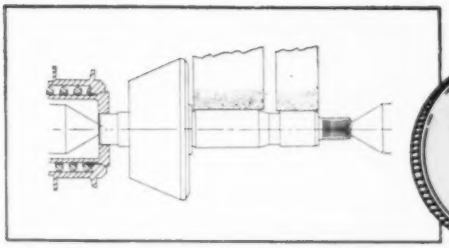
When a Type CTU Grinder is arranged for fully automatic loading and grinding of valve pistons the part is held on centers and driven by a floating type collet. Work is ground by a double-wheel mount.



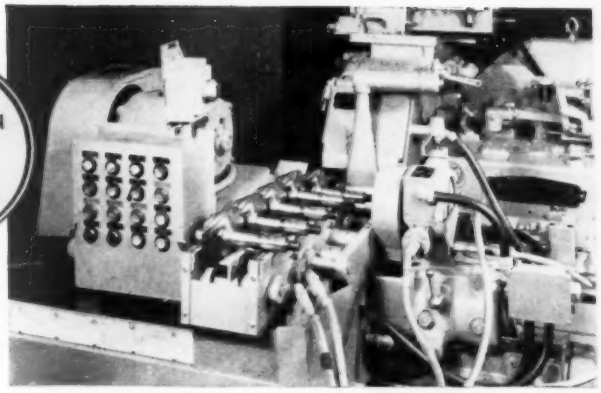
SAVINGS ON *Transmission Sleeves*



On this Type CV-4 Angular Wheelslide Grinder chucked grinding of transmission sleeves is arranged in a completely automatic cycle. Longitudinal movement of a revolving turret loads the machine. A stripper type plate removes the piece when turret retracts as the grind is terminated by electrically timed control.



SAVINGS ON *Stem Pinions*



The Stem Pinion Grinder reduces time and effort with a completely automatic cycle, electrically timed arrangement for grinding these hard-to-handle parts. Progressive escapements in the automatic loading mechanism release the parts in succession, avoiding gear mesh.

NEW ECONOMY!

Norton No. 2 Unitized Transfer Grinder Grinds Crankpins Automatically

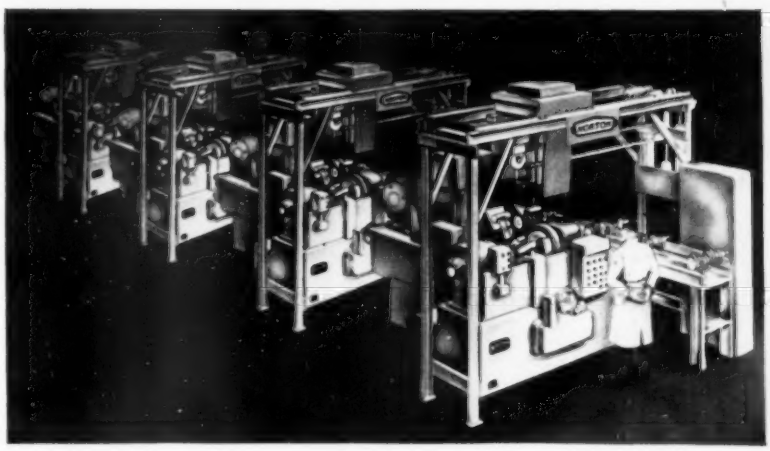
Here's a newly developed machine that automatically grinds crankpins faster and for less money than ever before possible. Advanced features like the following are reasons why:

Unitized Operation. Each grinding station, operating independently, can be automatically by-passed without affecting continuous production.

New Transfer Mechanism. Double set of hooks speeds loading, unloading and transferring of crankshafts from one grinding unit to another.

Fast Production. Cycling grinds 240 crankpins on 60 V-8 crankshafts per hour, due to many automatic operations.

Only One Operator Needed. Others are freed for different jobs. And the machine reduces floor-space requirements.



Norton has developed a wide range of fast, automatic grinders. You can get them in conventional and angular wheelslide types — also in special types for grinding automotive valve faces and crankshaft pins.

Remember: only Norton offers you such long experience in both grinding machines and wheels to bring you the "Touch of Gold" that helps you produce more at lower cost.

For further information about these machines — including how the No. 2 Unitized Transfer Crankpin Grinder can save you many dollars daily — contact your Norton Representative. Or write to NORTON COMPANY, Machine Division, Worcester 6, Mass.

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TOOLING FOR COMPETITION

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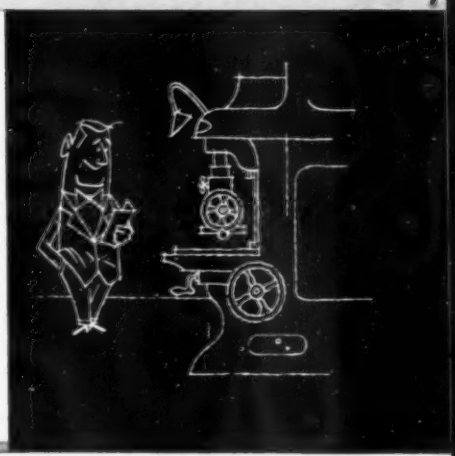

ATTEND top level conferences, conducted by recognized authorities on the newest production techniques and developments.

Symposia, panels and technical papers (more than 80 of them) will be devoted to timely subjects of vital interest to today's industry . . . subjects like the following . . . Automation* • Materials of the Future • Numerical Control • Guided Missiles • Plastic Tooling • Nuclear Engineering • Shaped Diamond Tools* • Planning for Profit • Ceramics • Powdered Metal Parts Tooling • European Tool Engineering • Gauging Techniques • Safety Engineering • Metal Cutting* • Shell Molding.

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Industry's "D-men" . . . designers, deciders, doers . . . will be out in strength for the 1958 *TOOL SHOW*. ASTE's Registration Listings, in fact, read like blue ribbon rosters of industrial America. And small wonder! . . . for the ASTE *TOOL SHOW* is industry's greatest open forum for exchanging ideas, solving problems, *"tooling for competition"*. What better opportunity for keeping yourself informed and up-to-date? . . . and what could be more important in these competitive times?

INSPECT the modern equipment and up-to-the-minute manufacturing methods being utilized in booming Delaware Valley plants.

Yes, you'll have an opportunity to see industry in action, too, because arrangements have been made for 28 tours through Philadelphia area plants . . . including the U.S. Navy Yard.

These 14 plants will be open for your inspection . . . Standard Pressed Steel • U.S. Steel • Leeds & Northrup • Chrysler-Plymouth • Cuneo Eastern Press, Inc. • Campbell Soup Co. • I.T.E. Circuit Breaker • Schramm, Inc. • Yale & Towne • Budd Company • Brown Instrument • Link-Belt • Fischer & Porter • Curtis Publishing.

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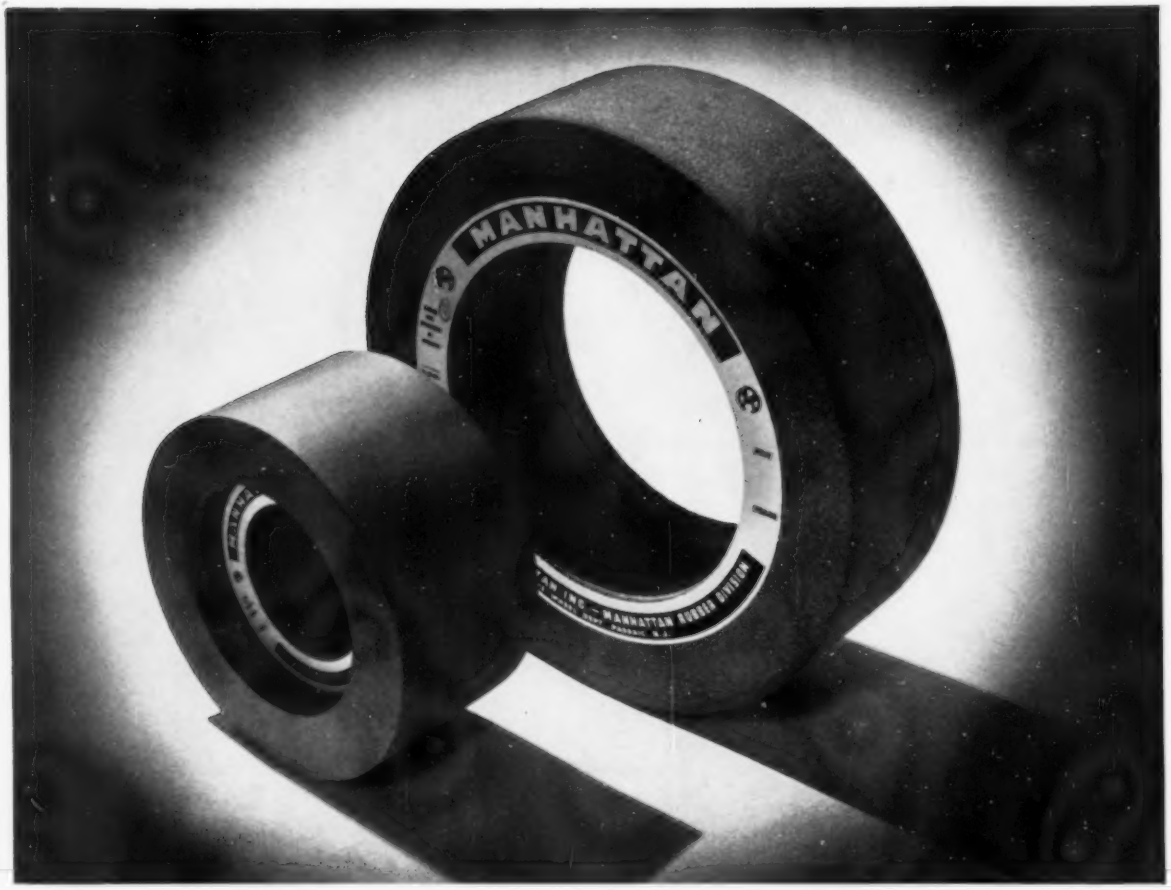

MANHATTAN CENTERLESS WHEELS

Handle Roughing AND Finishing . . . at Lower Cost

Manhattan Centerless Wheels are specially bonded to permit both roughing *and* finishing with the *same* wheel. Their special high grit-carrying rubber bond insures maximum metal removal with every pass — produces desired finishes to required tolerances even with coarser abrasives! By controlling the feed rate and the amount of stock removed you can move easily from roughing to finishing operations without time consuming wheel changes! The greater strength of Manhattan Centerless Wheels permits grinding speeds up to 8500 sfpm. It all adds up to a faster, better roughing and finishing job — at substantial savings in production time and costs.

Manhattan Rubber Bond Centerless Grinding and Regulating Wheels are custom-made for your specific requirements. Manhattan Regulating Wheels are supplied either plain or core-mounted. Manhattan Core Mountings provide substantial savings in wheel costs. Ask a Manhattan representative to show you how Manhattan Centerless Wheels and other Manhattan high speed, heavy duty wheels do a *better* job, *longer* . . give you "More Use per Dollar."

RM 643

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MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

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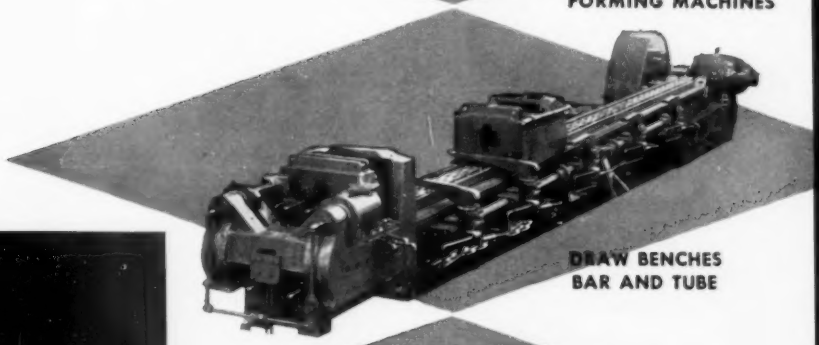
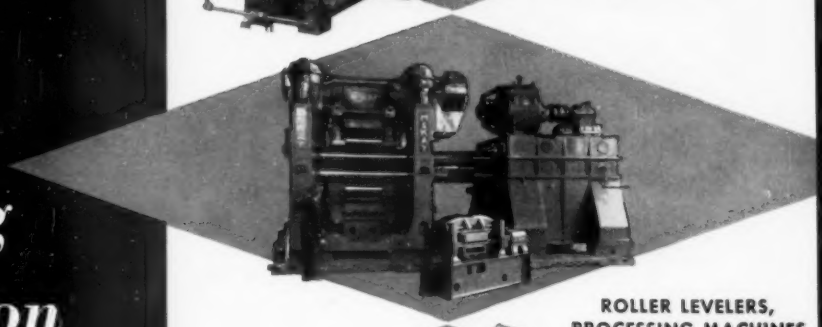
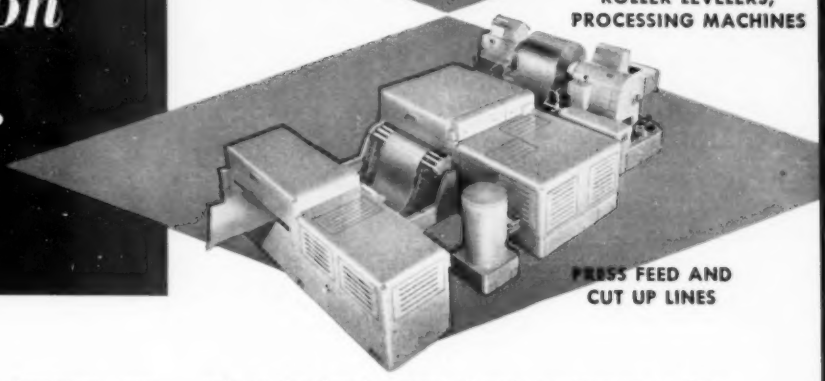
FORMING MACHINES



DRAW BENCHES
BAR AND TUBE



ROLLER LEVELERS,
PROCESSING MACHINES



PRESS FEED AND
CUT UP LINES

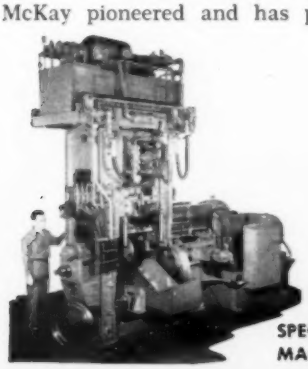
Metal working Automation in action...

If you're in the metal working business, you should be acquainted with McKay *automated* lines available for many metal working operations.

McKay pioneered and has played a leading role in the development of such equipment as that pictured on this page.

Basic McKay designs can be modified, or special machines developed to meet specific requirements.

THE McKAY MACHINE CO., YOUNGSTOWN, OHIO

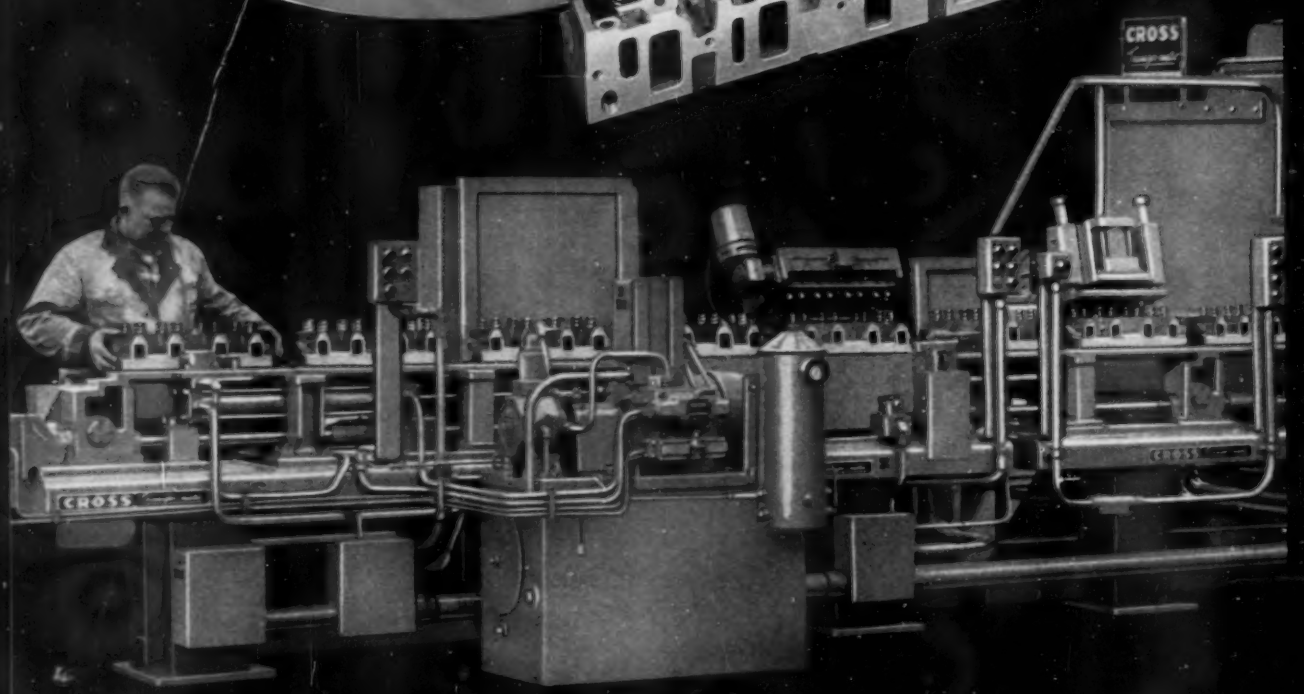


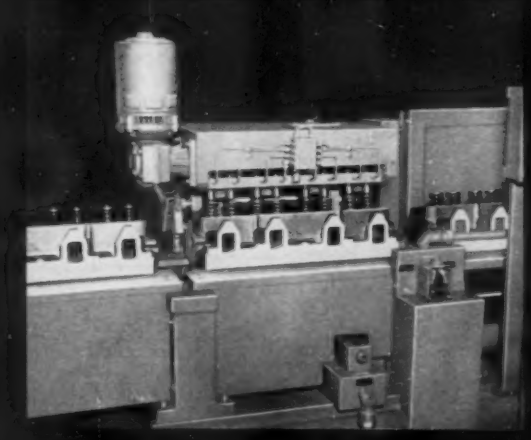
SPECIAL
MACHINERY

McK

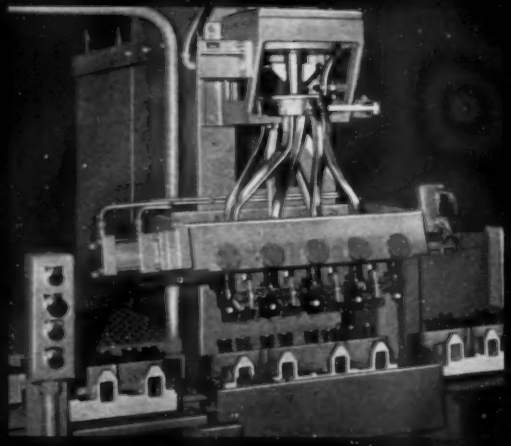
104

Automation for Cylinder Head Assembly



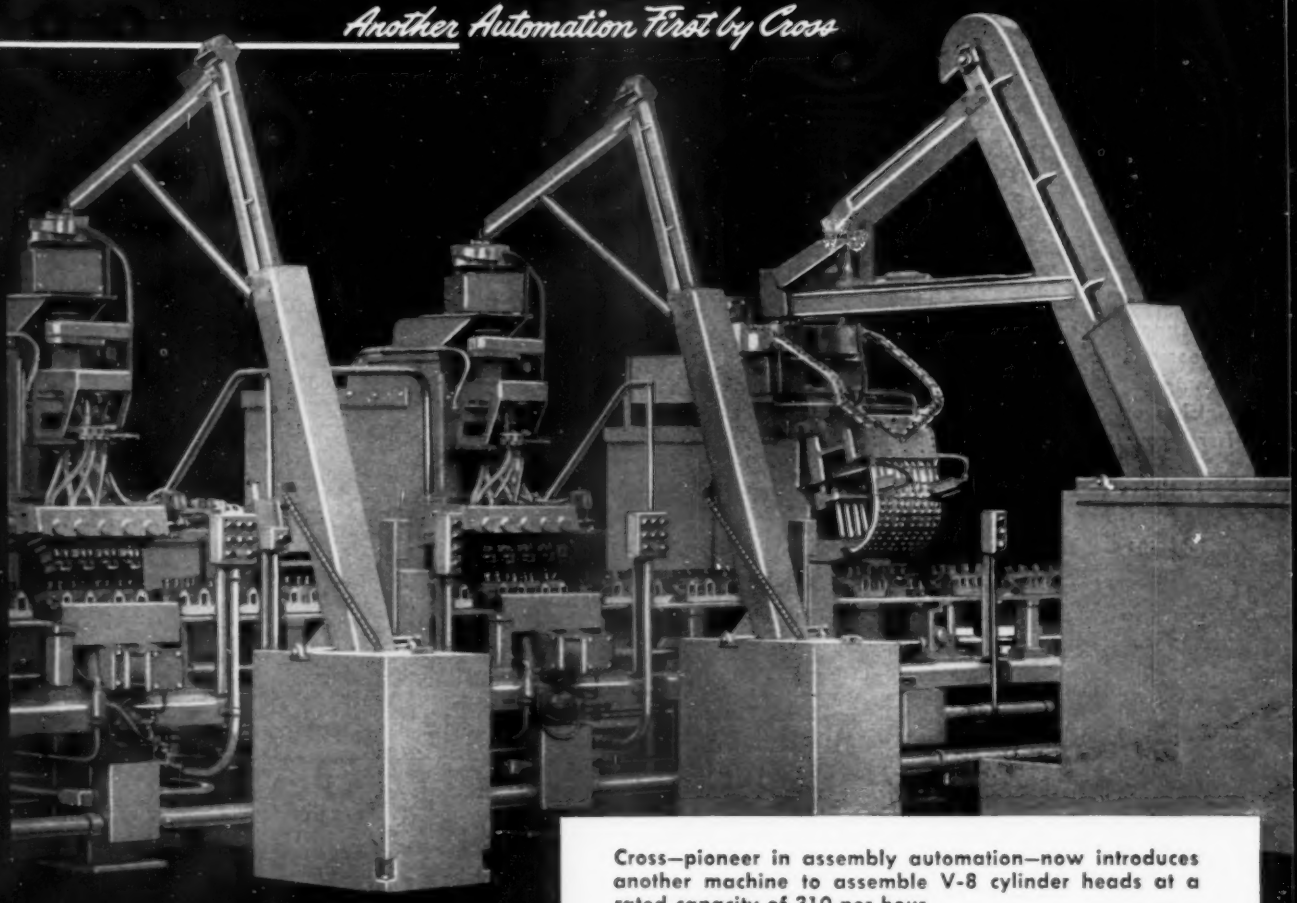


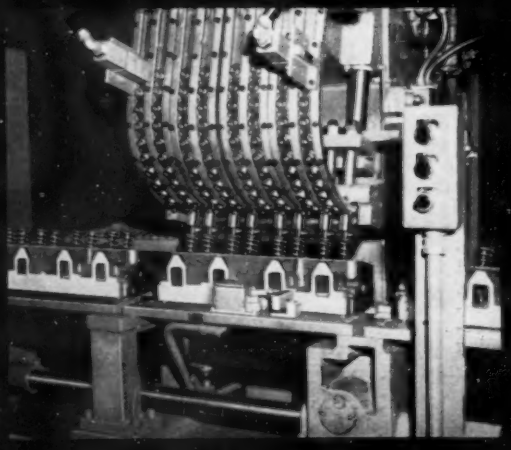
Station 25: Valve "popping".



Station 17: Automatic assembling of valve locks.

Another Automation First by Cross





Station 13: Automatic assembling of valve spring retainers.

Cross—pioneer in assembly automation—now introduces another machine to assemble V-8 cylinder heads at a rated capacity of 310 per hour.

Cylinder head castings with intake and exhaust valves in place are loaded automatically at Station 1. At Stations 3, 4, and 5, rubber grommets are placed over the valve stems. At Station 7, an inspection is made for faulty valves and grommet positioning. If necessary, heads are removed, repaired and returned at Stations 8, 9, and 10. Valve springs, spring retainers and spring retainer sleeves are automatically assembled at Stations 11, 13, and 15 respectively. Valve locks are automatically assembled at Stations 17 through 23 with standby units for manual assembly at Stations 19 and 23. At Station 25, all valves are "popped" before unloading the finished assemblies at Stations 27, 28 and 29.

A unique feature of the machine is the transfer mechanism which lifts and carries the parts between stations to eliminate pallet fixtures used by older assembly machines.

Building block construction provides flexibility for engine design changes and for additional automatic assembly devices of the future.

Like other Cross machines, all parts—even tooling details—are made to interchangeable tolerances for fast, easy maintenance. Other features include construction to JIC standards and automatic lubrication.

Established 1898

THE CROSS CO.

First in Automation

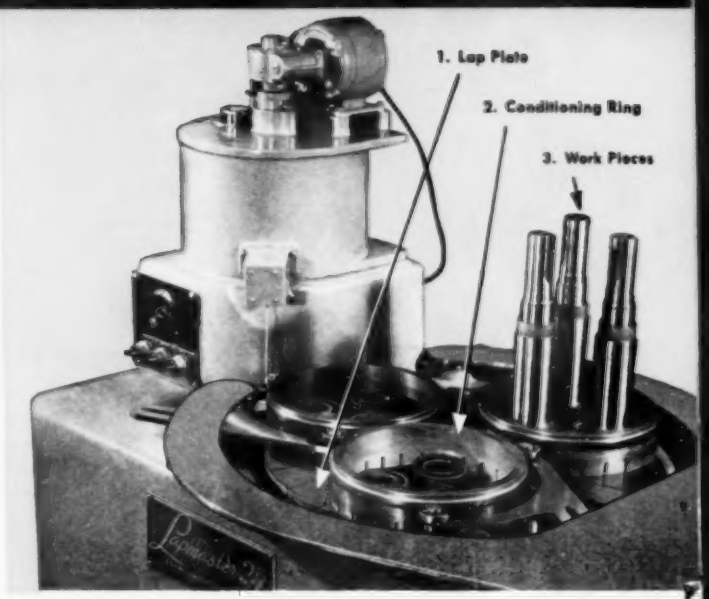
PARK GROVE STATION • DETROIT 5, MICHIGAN

FACTS ABOUT HOW PRODUCTION LAPPING SAVES YOU MONEY—IMPROVES YOUR PRODUCT

With the *Lapmaster*® Principle

The Lapmaster is a versatile precision machine engineered to production *lap* flat surfaces within tolerances of .0000116" or less and microinch finishes of 2 to 3 RMS with absolute uniformity. *Here's how it works:*

1. **Heavy cast iron lap plate revolves slowly under power.**
2. **Large cast iron conditioning rings are held in position and rotate freely on the lap plate . . . continually keeping the plate flat and true.**
3. **Work pieces are placed inside the conditioning rings where they also rotate on the lap.**
4. **Fresh, sharp abrasive grains, suspended in a suitable vehicle, are continuously fed on the lap plate and uniformly distributed under the work pieces during the lapping action.**



WHY THE LAPMASTER IS TRULY A PRODUCTION MACHINE

Identical parts or parts of various shapes, heights and materials can be lapped simultaneously on one machine.

Production is not interrupted or slowed down for replacing or reconditioning lap plates.

Simplicity of design with no obstructions makes loading and unloading easy and simple.

Exclusive design and method of operation with greater effective lapping area permits more loadings per cycle.

Short, predetermined lapping cycles are automatically controlled by a timing clock for greater production efficiency.

Automatic cycling permits pre-loading additional work holders while machine is in operation.

HOW COSTS ARE CUT...PRODUCT IMPROVED

These excerpts from letters sent in by actual Lapmaster users tell the story better than our own words.

"... never been a reject from the work performed on this machine."

"... gives us better quality with less scrap and reduced labor costs."

"... maintenance costs only approximately $85.00 whereas old method was costing approximately $8000.00 per year."

"... machine will save its costs in 2 years by salvaging the mechanical seals for us which would otherwise have been discarded."

"... have dispensed altogether with tests for leakage."

"... the Lapmaster has more than paid for itself—we've eliminated a finish grinding operation and save on expensive fixturing."

HOW DOWNTIME IS ELIMINATED

The Lapmaster is the only lapping machine that does not have to be stopped for redressing or truing the lap plate. Flatness of the lap plate is continuously maintained by the patented reconditioning action of the conditioning rings.

WHAT ABOUT PART SIZE AND SHAPE?

Standard machines in the Lapmaster Line will handle parts from ¼" up to 30½". Shape or form is not a problem . . . tall or squat, long or short, flat or odd shaped . . . all are being lapped on Lapmasters throughout industry. Monel, steel, tool steel, bronze, cast iron, stainless steel, aluminum, brass, quartz, ceramics, plastics, etc. can all be lapped with the same lap plate.

OPERATOR NEED NOT BE EXPERIENCED

Unskilled operators can be used since the only manual work required is loading and unloading the pieces.

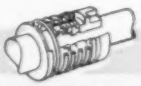
PROVE IT TO YOURSELF WITH THE LAPMASTER TECHNICAL SERVICE

One sure way to find out if the Lapmaster can save you money is to send us samples and surface finish specifications of parts. We'll test run them in our experimental lapping laboratory and furnish you with a complete production report without obligation. Or write for FREE Booklets with complete facts on producing and measuring precision flatness and finish.

Crane Packing Co., 6469 Oakton St., Morton Grove, Ill. (Chicago Suburb).
In Canada: Crane Packing Co., Ltd., Hamilton, Ont.

John Crane


MECHANICAL PACKINGS

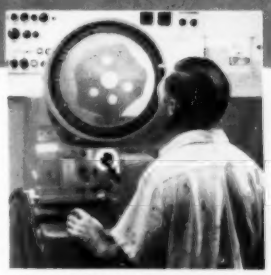

SHAFT SEALS


TEFLON PRODUCTS


LAPPING MACHINES


THREAD COMPOUNDS

CRANE PACKING COMPANY



With this Kodak Contour Projector Auburn Plastics, Inc., accurately gages a great variety of parts down to .001". Operator can easily measure angular dimensions on cams and keys, threaded mold components, center-to-center dimensions on parts and tools.

How many gages to inspect these parts?

Just one—if it's a Kodak Contour Projector.

Auburn Plastics, Inc., of Auburn, N. Y., a venerable custom molder, produces a wide variety of component parts for various manufacturers. Formerly this firm needed many mechanical gages to make necessary quality control checks.

A *Kodak Contour Projector* eliminated the expense of buying such gages—amounting in *one instance to a saving* of *$5,000.*

In a fiercely competitive business, Auburn Plastics, Inc., can submit *lower* bids because of savings permitted by *optical gaging.* The company effects additional economies by using its Kodak Contour Projector to inspect *tools* and *dies* as well as manufactured components. In all cases the projector permits gaging of angles, radii, holes and other dimensions—at a glance.

If you have an inspection problem involving myriad small parts, you can do the job easily and inexpensively with a Kodak Contour Projector. Inspection is a matter of comparing the projected image of the part with a chart gage on the screen. You inspect different types of parts simply by changing chart gages. Operators need little training.

For additional information or to arrange for a demonstration of any of the 6 Kodak Contour Projector models, write to:

Apparatus and Optical Division

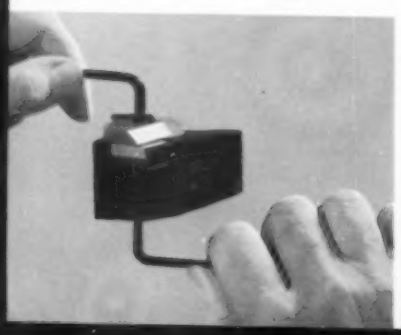
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

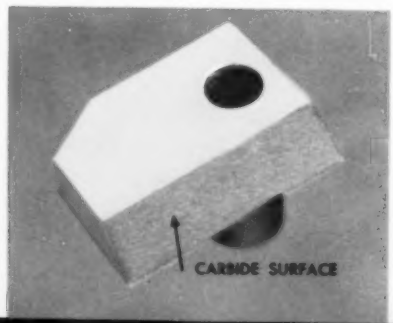
Kodak
TRADE MARK

1 New! Self-loosening chipbreaker clamp. A twist of the wrist releases insert for indexing . . . automatically lifts and lowers chipbreaker. No more prying chipbreaker free. No more fumbling with loose chipbreaker. Choice of 3 chipbreaker widths for accurate chip control.

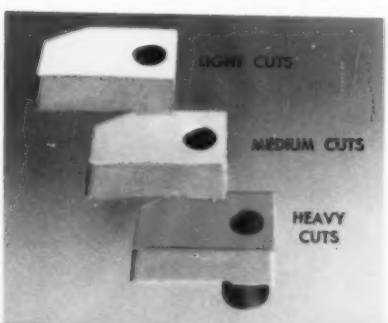
2 New! Setscrew accessible from top or bottom! Screw easily reached when holder is upside down or on its side. Easier indexing from any position.

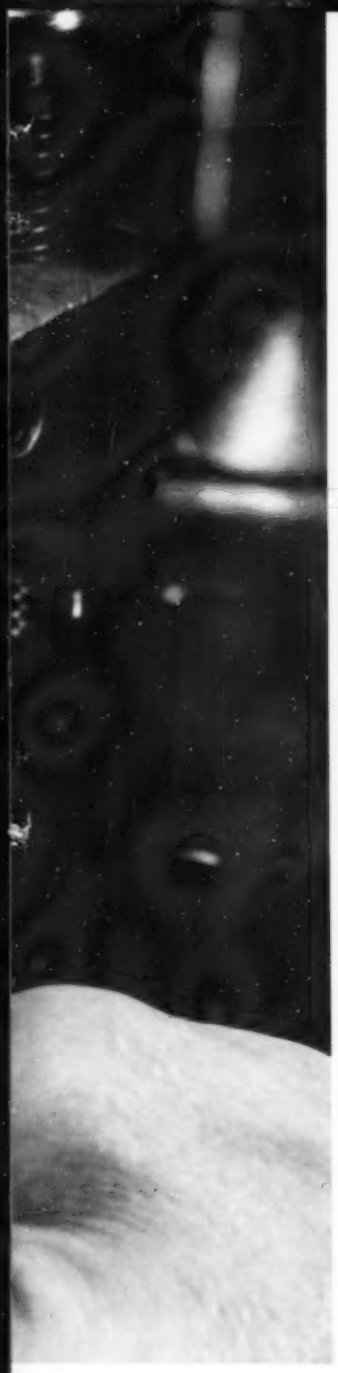


3 New! Unique carbide-surfaced chipbreaker. New method bonds carbide coating directly to chipbreaker. Ends all possibility of braze failure.



4 New! Three color-coded chipbreakers. Choice of three widths: yellow for light cuts, silver for medium cuts, red for heavy cuts. Makes identification easy.





ANNOUNCING THE ALL-NEW CARBOLOY® LIFT-O-MATIC TOOLHOLDER

Only toolholder on the market with these 6 advanced design features

Indexes faster, easier – from any position. Setscrew on Carboloy Lift-O-Matic Toolholder can be turned from either top or bottom. Even if the holder is upside down, or on its side, the setscrew is always easily accessible.

What's more, the clamp and chipbreaker are in one piece – and rise automatically when the setscrew is loosened. There's no time wasted in fumbling with the chipbreaker or prying it free.

Reduces set-up time, speeds up production. Because Carboloy Lift-O-Matic Toolholders can be set up faster and indexed right in the machine, downtime is reduced – you get more production.

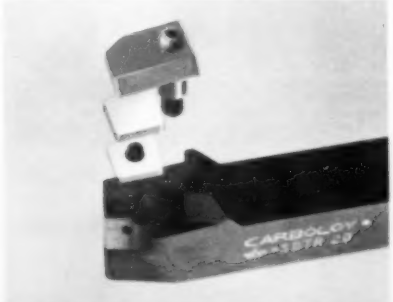
Because of the new holder design and harder steel shanks, you get closer tolerance production . . . less scrap loss.

17 styles in 8 sizes—stocked for immediate delivery. Lift-O-Matic Toolholders are now at your local Authorized Carboloy Distributor. Call today; his name is in the Yellow Pages. Or, for new Lift-O-Matic Toolholder Catalog, write: *Metallurgical Products Department of General Electric Company, 11173 E. 8 Mile Ave., Detroit 32, Michigan.*

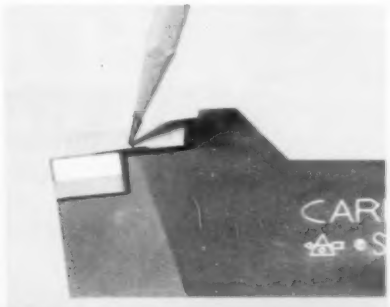
CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC

5 New! Fewer parts to replace or stock. Holders use fewer parts. And all are standardized to cover widest range of applications. Means reduced inventories.



6 Insert clears top of the shank. Stops chipping of fresh cutting edges against walls of insert pocket. Inserts are positively clamped; clamp never touches shank.



NEW! TRANSPARENT PACKAGES FOR CARBOLOY INSERTS

New plastic package makes it easy to see what's inside...easy to pick out insert.

be a Profit prophet ...without Crystal Ball!

Users of U. S. Adjustable Drill Heads are unusually accurate in anticipating profit pictures— they regularly figure lower and *more dependable costs.* That's because these high-quality heads—priced right to start with—usually cost less to maintain, less to operate.

The U-1 Head shown has 8 drivers, ¼" drilling capacity in cast iron, 6" diameter drilling area. With 2 spindles and Erickson chucks, it costs only $260.

And that's because ALL U. S. Heads of this type have these plus features:

SHAVED GEARS for smooth, quiet operation.
SPECIAL UNIVERSALS with heat treated joints, neoprene sealed and lubricated for life.
ALUMINUM BODY CASTING with special 33,000 lb. tensile.
GREATER BEARING AREA for the spindles.
QUICK CHANGEOVER for different hole patterns.
SLIP SPINDLE PLATE, providing the advantage of a fixed center head on long runs.

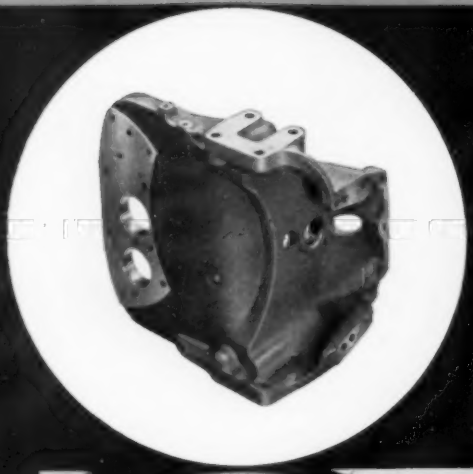
Write for catalog AD-57. Immediate delivery on most standard sizes.

Adjustable and Fixed Center Multiple Drilling Heads
Individual Lead Screw Multiple Tapping Heads

US DRILL HEAD

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO



At Massey-Harris-Ferguson

Natcos Save 100 Parts...

Three multiple-spindle Natcos bore, drill, spotface and tap the front end support for a Massey-Harris-Ferguson tractor

NATCO

60 Man Hours Every

on Rugged Axle Support Castings

Massey-Harris-Ferguson checked it two ways. Nine general-purpose machines would do the job—or 3 Natcos. They chose the Natcos for these reasons:

- *Saving of $30,000 in machine cost*
- *Saving of 60 man hours every 100 parts*
- *Saving of 65% in floor space*

The Natcos handle all drilling, boring, spotfacing and tapping—a total of 67 operations on the 182-pound front axle casting. The casting is heavy, irregular—tough to fixture and clamp. The Natcos meet production requirement of 11 parts per hour.

Natco provided complete tooling which features automatic clamping, cycling and chip blow-out. All three machines are of unitized construction, giving Massey-Harris-Ferguson the flexibility to run different parts of redesigns of the same part.

Let Natco Field Engineers point out cost-saving and time-saving methods on your next drilling, boring, facing or tapping job. Natco offices are located in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.

National Automatic Tool Company, Inc.

Richmond, Indiana

Multiple-spindle drilling, boring, facing and tapping machines. Special way-type, index and transfer machines.

Another Record

One important factor contributing to another PRECISION PERFORMANCE record well known to users of Bay State taps is a surface treatment similar to so-called liquid nitriding. It resists abrasion and loading and thus increases wear life and productivity.

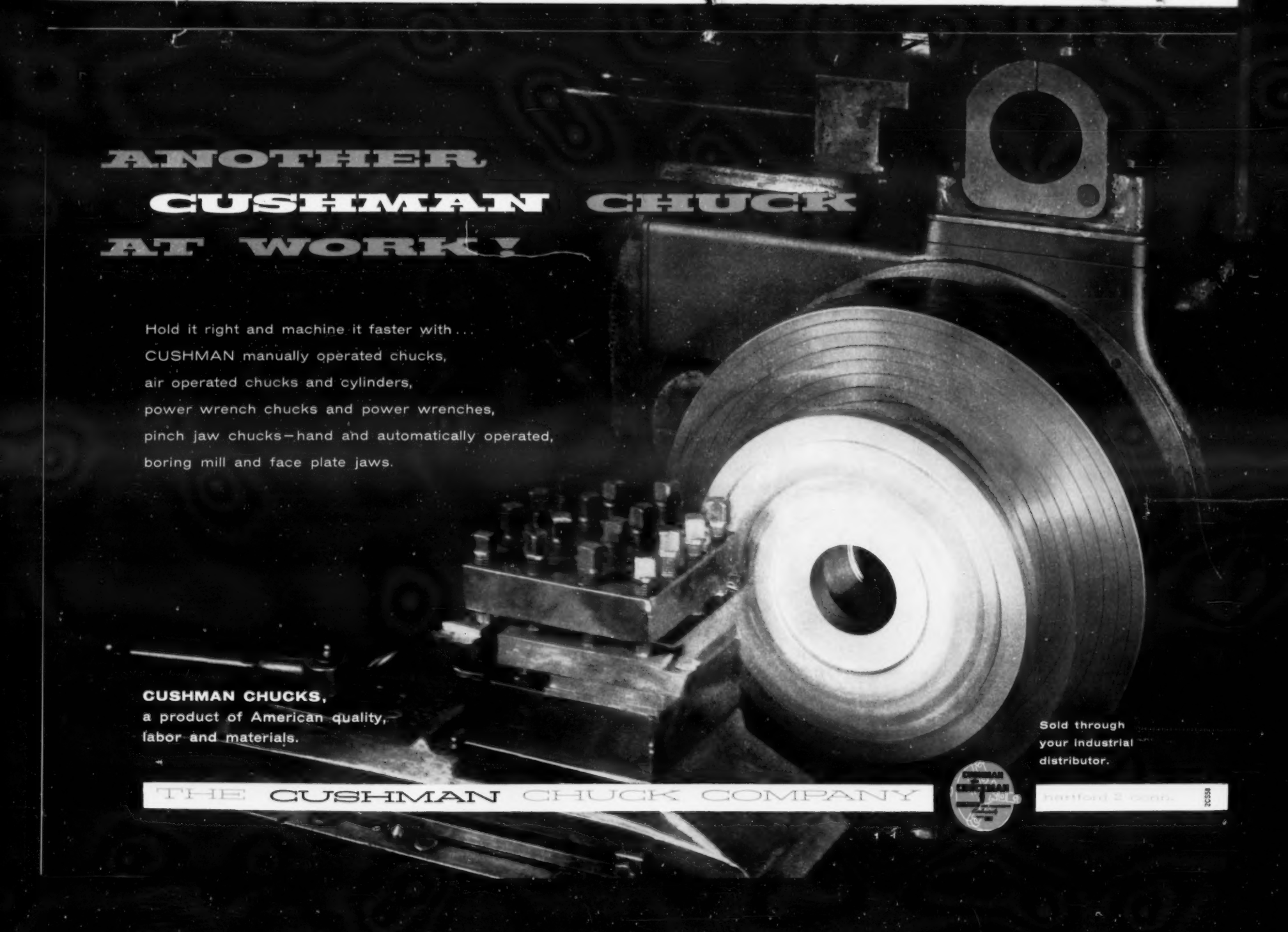
It is beneficial for tapping steel and sand cast aluminum and is a "must" for cast iron and stainless steel.

Order Bay State . . . and Requisition a Record!

On the nearby shelves of your Industrial Supply Distributor

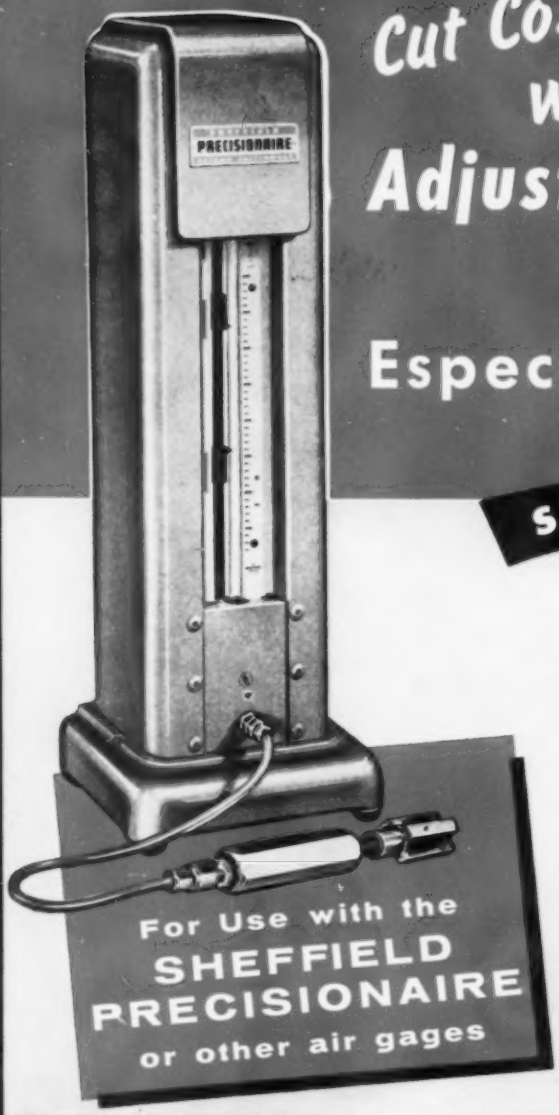
BAY STATE TAPS

Bay State Tap & Die Company • Mansfield, Massachusetts


ANOTHER
CUSHMAN CHUCK
AT WORK!
Hold it right and machine it faster with...
CUSHMAN manually operated chucks,
air operated chucks and cylinders,
power wrench chucks and power wrenches,
pinch jaw chucks—hand and automatically operated,
boring mill and face plate jaws.
CUSHMAN CHUCKS,
a product of American quality,
labor and materials.
Sold through
your industrial
distributor.
THE CUSHMAN CHUCK COMPANY

Cut Costs with SHEFFIELD *Adjustable* AIR GAGE TOOLING

Especially for Short Runs and Emergencies



SUCH AS:

- Aircraft manufacturers, subcontractors and job shops having limited production.
- Accidental damage to a vitally needed single purpose gage.
- An unexpected engineering change involving part size.
- A short run of special parts for which no gages have been provided.
- A mistake or failure in ordering the needed single purpose gages.
- Sudden need for process gages at the production machines.

Don't let any of these situations cause costly scrap, delays or embarrassing confusion in inspection, in the shop or in the toolroom. A small investment in the tooling here illustrated is your best insurance against unpredictable production losses.

Write Div. 19 for descriptive engineering data. *THE SHEFFIELD CORPORATION, Dayton 1, Ohio, U.S.A.*

All items shown here are stocked for immediate delivery—no waiting.

Economical, Adjustable Balljet Spindle Kit

In 5 minutes you can assemble, for precision gaging, a spindle for ANY SIZE hole from 1" to 3" in diameter.

Consider economy for a moment. If the holes you may encounter vary in increments of .001", this Kit provides the equivalent of 2000 Spindles at a unit cost of less than a dollar. If those increments are .0001" you have available 20,000 Spindles at about a dime each. That is real economy.

No auxiliary equipment needed except conventional gage blocks—NOT EVEN ONE MASTER SETTING RING.


Balljet Spindle assembled


Balljet Spindle in use


Calibrating Fixture

Adjustable Balljet Spindle Kit

Adjustable Airebore Gage

Adjustable Airebore Gage

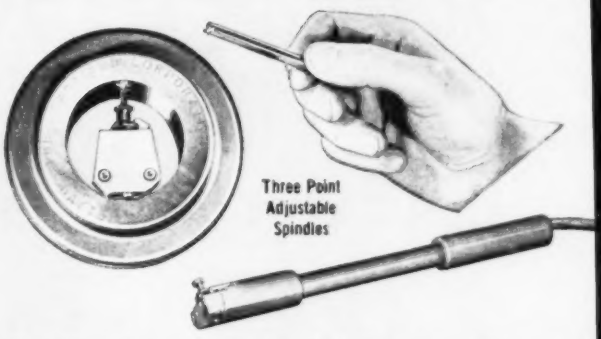
Airebore Gage in use

Airebore Gage assembled

The Airebore Gage can be set precisely to measure any diameter hole from 3″ to 12″. And like the Adjustable Balljet Spindle, it is set up with a calibrator and gage blocks. No master setting rings are needed.

The Airebore Gage is self-centering—needs only to be rocked in place for precision action. It is light in weight with all contact surfaces of tungsten carbide—nothing to wear out.

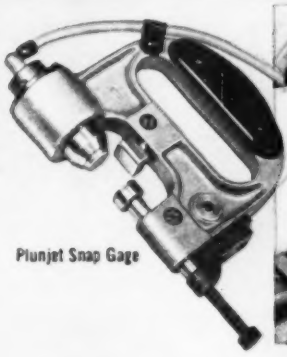
Three-Point Adjustable Spindles



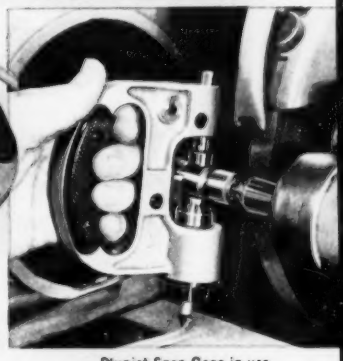
Three Point Adjustable Spindles

The Three-Point Adjustable Spindles, four of them, cover respectively the ranges, ⅜″ to 9/16″, 9/16″ to 1″, ⅞″ to 1½″ and 1½″ to 3″. They can be set up with gage blocks.

Plunjet Indicator Snap Gage



Plunjet Snap Gage

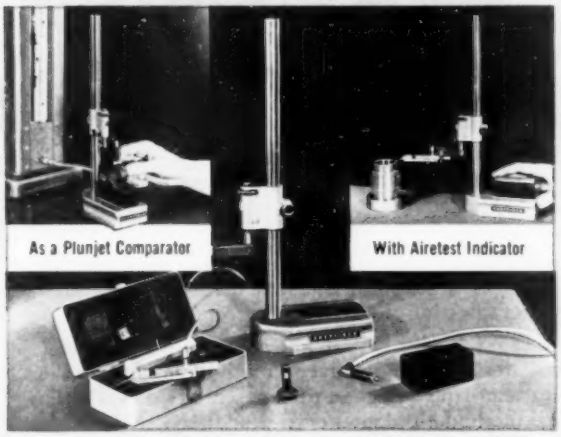


Plunjet Snap Gage in use

The Plunjet Gaging Cartridge may be substituted for the Dial Indicator to assure consistent, repetitive readings, especially when tolerances are .001″ or less.

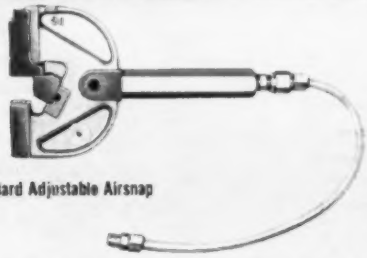
Twelve Plunjet Snap Gage models cover the gaging range of 0″ to 12″. Larger sizes are available on special order.

Airetest and Plunjet Stand



A new, highly versatile stand accommodates a dial indicator or an Airetest Indicator—also converts to a comparator by using a Plunjet and anvil as illustrated.

Standard Adjustable Airsnaps



Standard Adjustable Airsnap

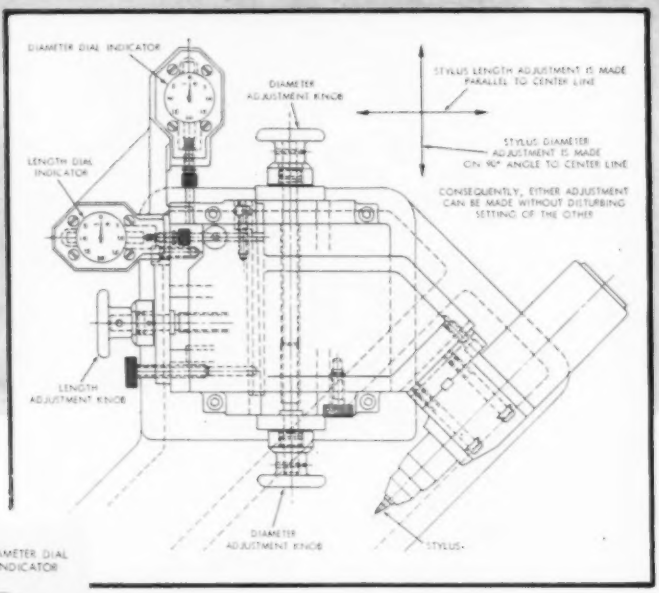
The Standard Adjustable Airsnap in 17 models covers the range .2500″ to 5.500″. Up to 3.000″ the adjustable anvil has a maximum adjustment of ¼″. Above that the maximum is ½″.

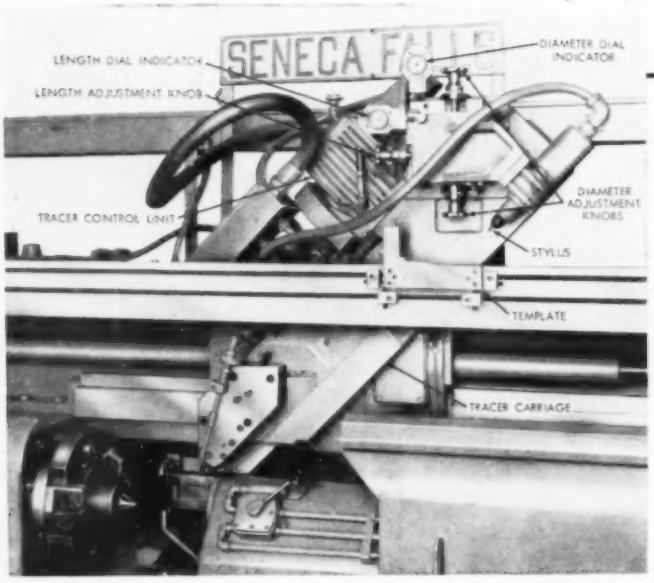
the SHEFFIELD corporation
of Bendix Aviation
manufacture and measurement for mankind

7839R

YOU CAN SET TOOLS IN SECONDS

on this SENECA FALLS TRACER LATHE





Where it used to take minutes by the old "cut and try" method, it now takes only seconds to adjust tools on the new Seneca Falls Model Q Automatic Tracer Lathes. Diameter and shoulder length accuracy are controlled by the stylus which is adjusted by means of compound slides operating in conjuction with two dial gages. One dial indicates diameter, while the other indicates shoulder length. The operator simply takes an initial cut over the work piece and sets the dials to zero. The work piece is then checked with micrometers to obtain out-of-tolerance readings, after which the stylus is accurately adjusted in one setting, by turning the slide adjustment knobs until the hands on the dials indicate the correct amount of stock removal. After the stylus is properly adjusted for size and length, the hands on the dials are again set at the zero mark.

Diametral and length adjustments are made by the "straight line" method, which does not affect either adjustment when feeding in the tracer slide. See line drawing for explanation.

Another advantage of the dial gages is that tool adjustment for wear is visually indicated on the dial and permits resetting the stylus to zero position when the tool insert is indexed or changed for a fresh cutting edge.

The dial indicator system facilitates a fast changeover from one part to another when used in conjunction with templates designed to compensate for variations in size of the work pieces. This method eliminates even the initial "trial cut," as the first piece turned is accurately machined to the specified dimensions.

SENECA FALLS MACHINE

ENGINEERED FOR PROFIT

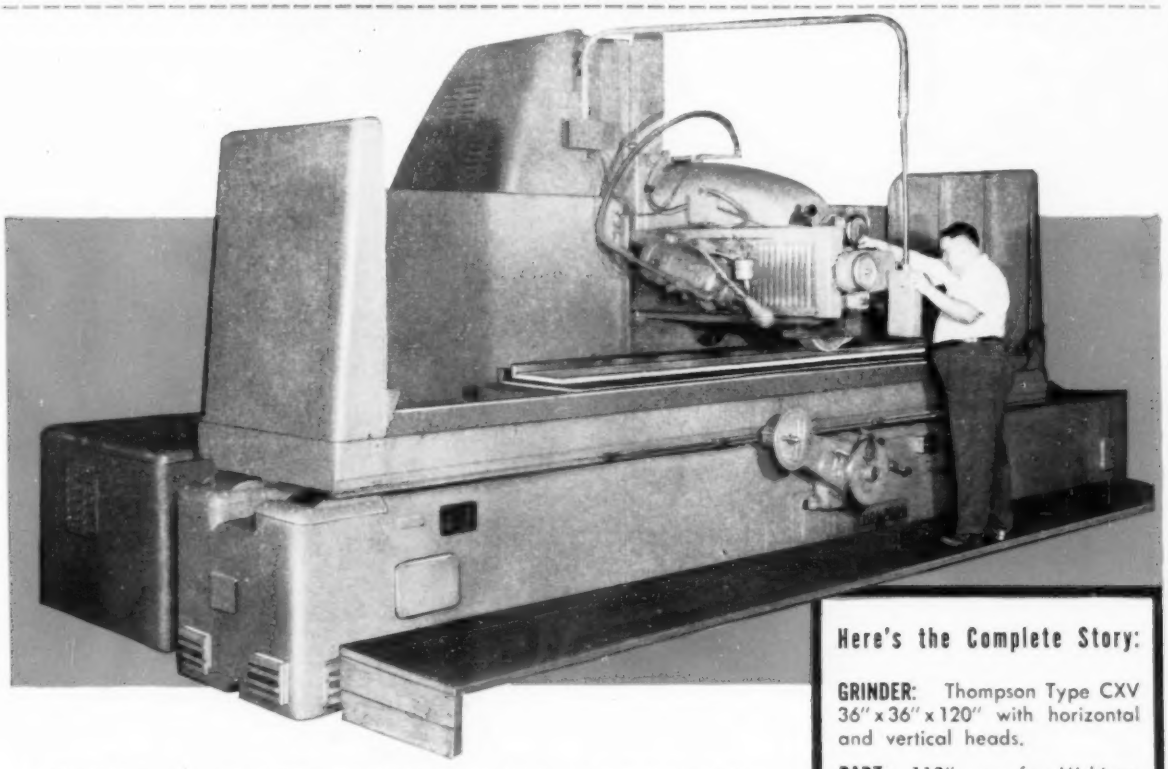
SENECA FALLS MACHINE CO.

SENECA FALLS, NEW YORK

Lo-swing Lathes and Seneca Falls Machine Tools, Automation and Electronics

When large parts must be ground to total tolerances of .0005" or less . . . .

THOMPSON GRINDERS WITH THE NEW HYDRA-COOL HYDRAULIC SYSTEM SOLVE THE PROBLEM!



Machine ways up to 118" for The Michigan Tool Company's Roto-Flo Spline Rollers must be ground to .0005" total tolerance. Heat distortion, caused by hydraulic heat, became a critical problem in achieving this tolerance.

During the three months of operation since the installation of Thompson's new Hydra-Cool Hydraulic System*, these long ways are being ground to consistent .0003"-.0004" total tolerances. Heat distortion is eliminated. Scrap loss is reduced to zero. Grinding time is greatly reduced.

THOMPSON GRINDERS WITH THE NEW HYDRA-COOL HYDRAULIC SYSTEM MAY BE THE ECONOMICAL SOLUTION TO YOUR GRINDING PROBLEM. WRITE TODAY FOR FULL PARTICULARS.

Hydra-Cool also offers you these exclusive advantages:

- Heat damage to hydraulic seals, valves, controls and pump is eliminated.
- Break down of additive-type hydraulic oils is prevented—sludge will not form in the Hydra-Cool System.
- Lengthy warm-up periods are eliminated.
- Power costs are greatly reduced.

Hydra-Cool is standard on all Thompson surface grinders 40 inches and up in work length AT NO EXTRA COST.

Here's the Complete Story:

GRINDER: Thompson Type CXV 36" x 36" x 120" with horizontal and vertical heads.

PART: 118" way for Michigan Tool Co. Roto-Flo Spline Roller.

RATE OF TABLE TRAVEL: 100 ft./Min.

MATERIAL REMOVED: .065".

METAL: Flame hardened Ductile Iron.

WHEEL: 20x4x12 H Grade.

SCRAP LOSS: None.

GRINDING TIME: 3-4 hrs.

Thompson SURFACE GRINDERS

THE THOMPSON GRINDER CO., Springfield, Ohio, U. S. A.

*Pat. Applied For

*"Keep **THOMPSON** in mind for that daily grind"*

Gardner-Denver (Keller) 000RSD and 12A-2 screw drivers with cushion clutch, magnetic bit holder and Phillips insert bit assembling dual headlights for 1958 cars.

These Air-Operated Screw Drivers Are Paying for Themselves

If you drive only 400 screws a day, a Keller air-operated screw driver, such as those shown above, will pay for itself in six months. These lightweight air tools are easier on their users . . . help them keep pace with fast-moving assembly-line work.

Despite their high load factor, Keller pneumatic screw drivers run cool always. They have the right combination of torque, adjustable clutch and magnetic holding of screws for fast, efficient driving. They are the modern way to reduce assembly-line time and costs.

Send for the 40-page booklet. This Gardner-Denver booklet gives complete information about Keller screw drivers and nut setters, as well as other Keller air tools and accessories. A copy is yours for the asking.

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois

SIMONDS
ABRASIVE CO.

NEW SA Borolon®

TRADE MARK

Grinding Wheels

Ideal for tool and cutter grinding and horizontal surface grinding.

COOL ACTION HELPS TOOL STEELS HOLD THEIR TEMPER

SA Borolon is a unique and radically different aluminum oxide abrasive. Cutting particles are of single, uncrushed crystal formation for greater stress-free cutting edges. This is why these wheels give faster grinding with heavier cuts—and, at the same time, protect expensive tool steels with safe, non-burning action. Use SA Borolon wheels on your grinders.

Send for bulletin ESA 272 for details plus grain and grade specifications.

INDUSTRIAL DISTRIBUTORS — THE RIGHT HAND OF PRODUCTION

CALL YOUR SIMONDS DISTRIBUTOR

P roven products
D ependable know-how
Q uick supply

SIMONDS ABRASIVE COMPANY

Tacony & Fraley Sts., Philadelphia 37, Pa.

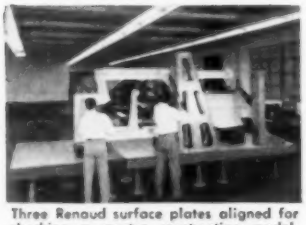
Division of Simonds Saw and Steel Co.

BRANCHES: Philadelphia • Chicago • Detroit • Shreveport • Los Angeles • San Francisco • Portland, Ore.

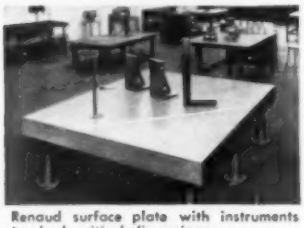
Renaud PLASTIC SURFACE PLATES

The Hottest Idea Since the Introduction of Granite

Fine Grain Granite Faced with Ren Plastic



Three Renaud surface plates aligned for checking a master construction model.



Renaud surface plate with instruments to check critical dimensions.

Dimensions are critical in constructing and checking this master gage for auto roof panel.

Developed by Renaud Plastics, Inc.—Builders of plastic tools, the Renaud surface plate is indeed the most outstanding development in this field since the introduction of granite.

All costly operations to produce a usable granite plate of close tolerances have been eliminated.

The Renaud way does not require laborious grinding and polishing, we simply take the same fine granite and surface it with Ren Plastic developed for this purpose. These plates are accurate within .002 T.I.R. of a true plane across corners, qualified for precision work and well within the required tolerances for steel tools, wood models, patterns and plastic tooling.

LOWER INITIAL COST

Savings on the cost of this type of equipment can be up to 50% of other types of surface plates.

FASTER DELIVERY

There are 8 standard sizes which can be delivered in less than half the time formerly required. Special sizes a little longer.

TRADE IN YOUR USED RENAUD PLATE

Should a Renaud plate need re-surfacing simply order a new plate and upon arrival return your used Renaud plate for generous trade-in allowance.

ALL THE ADVANTAGES OF GRANITE PLUS

the stability of a hard Ren Plastic surface which wears longer and is permanently level

- **Won't warp, swedge, rust or corrode**
- **Non-magnetic—abrasive resistant**
- **Needs no special care or oiling**
- **Repair is easier with Ren Plastics**

DIMENSIONS

Surface Dimension	Ledges No.	Ledges Ft.	Surface Dimension	Ledges No.	Ledges Ft.
24″ x 60″ (2′ x 5′)	0		48″ x 72″ (4′ x 6′)	0	
	2	10		2	12
	4	14		4	20
36″ x 60″ (3′ x 5′)	0		48″ x 96″ (4′ x 8′)	0	
	2	10		2	16
	4	16		4	24
36″ x 72″ (3′ x 6′)	0		60″ x 60″ (5′ x 5′)	0	
	2	12		2	10
	4	18		4	20
48″ x 60″ (4′ x 5′)	0		72″ x 96″ (6′ x 8′)	0	
	2	10		2	16
	4	18		4	28

Accurate within .002″ T.I.R. of true plane across corners.

SHIPPING WEIGHT

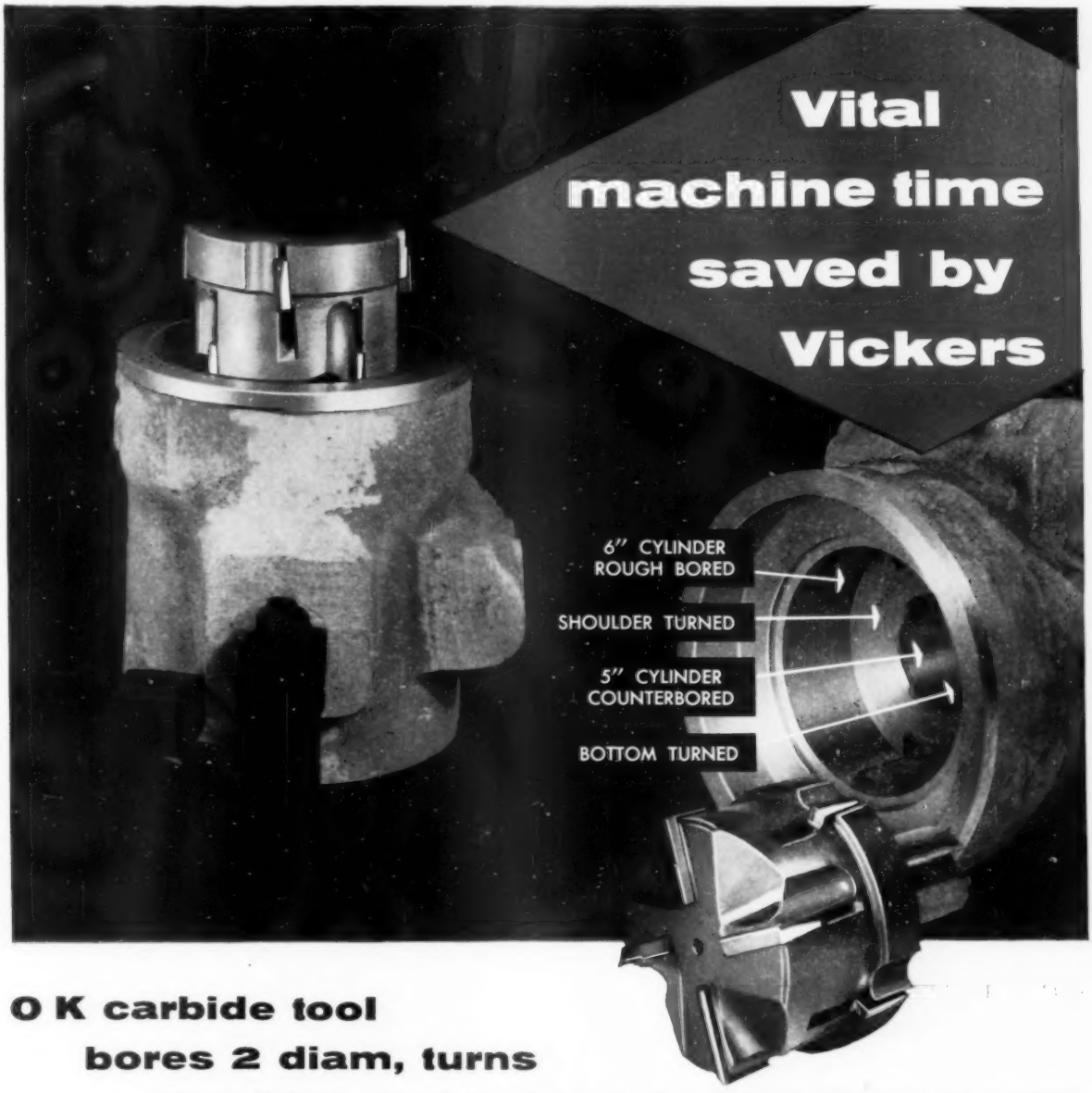
100# per sq. ft. for 6″ Thick — 170# per sq. ft. for 10″ Thick
135# per sq. ft. for 8″ Thick. — 200# per sq. ft. for 12″ Thick

WRITE FOR LITERATURE

Renaud PLASTICS, INC.

5422 S. Cedar Road • Lansing 17, Michigan

PLASTICS FOR INDUSTRIES SINCE 1938



O K carbide tool bores 2 diam, turns shoulder and bottom, in less than 2 min.

combination boring heads
multi-diam tools
trepanning tools
form cutters
gang mills
reamers

At the Waterbury plant of Vickers Incorporated, machine time is drastically reduced with this special O K carbide head for boring and counterboring cast iron hydraulic pump bodies. A single plunging cut completes four operations at the same time.
You can buy similar O K multiple-operation tools, boring heads, reamers, trepanning tools, gang mills for $150.00 to $200.00. An investment that pays for itself many times over, generally the first week the tool is on the job. Engineering service is free. Write for Book of 50 Engineering Prints of Multi-diam Tools.

modern milling cutters
for modern milling machines

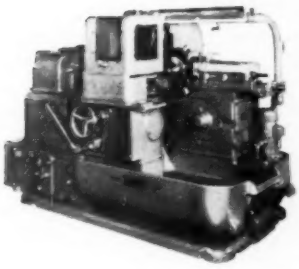
THE OK TOOL COMPANY, INC. • 300 Elm Street • Milford, New Hampshire

DO YOU NEED FLEXIBILITY?

TAREX HAS IT

...AND HERE'S HOW!

The illustration shows a Tar-H Machine with 2-9/16" bar capacity, 7" dia. chucking capacity, and . . .

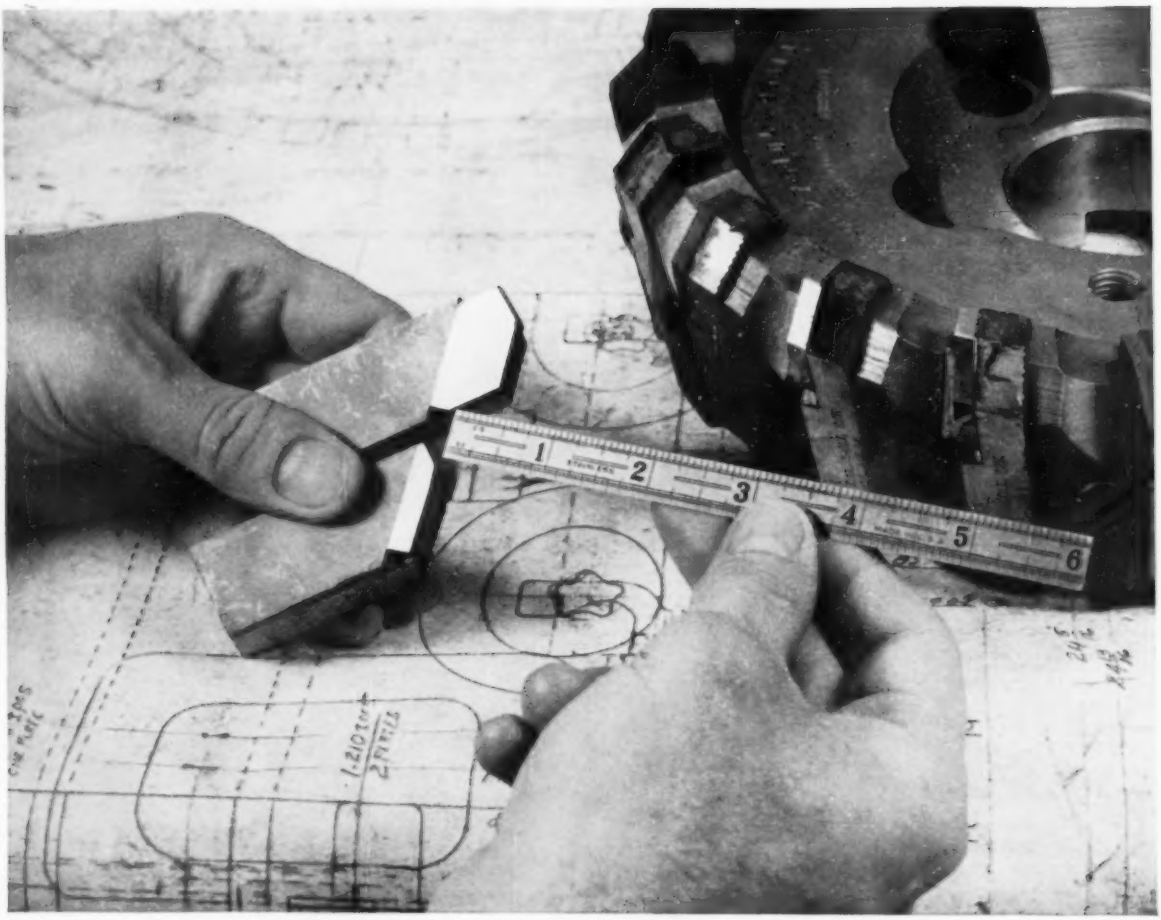


- A front slide with length- and cross-wise feed, using standard camming
- A rear slide that will single point angles up to 30°
- Two vertical slides
- A hydraulic tracing unit that will generate irregular sufaces with single point tools
- A multiple drillhead with drill speeding feature, spindle brake and positioning
- An 8-position turret

ALL THESE FEATURES, AND OTHERS, VARIABLE AT WILL!

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



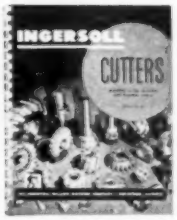
Ingersoll Heavy-Duty Shear Clear Face Mill designed for cast iron or steel. Size of bevel is varied to suit depth of stock.

What Does Your Scrap Barrel Show?

Do you get over ½" of blade wear? A look into your scrap barrel will show that many blades were wasted because of cracks, misuse, improper design or misapplication of the cutter and grade of carbide. You probably can't tell why these blades failed prematurely because so many variables are involved.

We are used to working with these variables and can help you reduce your tool costs. Part of our product is the continuous counsel of your Ingersoll representative and our cutter engineers. They will consider the machine, material, speed, feed and finish requirements before recommending the tool which will do the best job at the lowest cost.

We will welcome an opportunity to tell you more about this service. Write:



If you do not have a copy of this book, write us and we will send you one. It describes in detail the complete line of Ingersoll inserted blade milling and boring tools. Ask for Catalog #66F

CUTTER DIVISION

THE INGERSOLL MILLING MACHINE COMPANY

505 FULTON AVENUE ROCKFORD, ILLINOIS

It is EASIER TO INSTALL

It takes LESS SPACE

Its ACTION IS FASTER

It is EASIER TO CONTROL

FOUR GOOD REASONS WHY YOU SHOULD BUY THE BELLOWS AIR MOTOR ...THE AIR CYLINDER WITH THE BUILT-IN ELECTRIC VALVE

When it comes to downright value, it's hard to visualize an air cylinder that can even approach the Bellows Air Motor. For here is a complete packaged air cylinder power unit with all controls built-in: 8-12 volt, electrically-actuated directional valve*, two independent speed controls, and an air transfer system that makes it possible to bring air to the unit through a single flexible hose. No extra valves to buy, no cumbersome piping to install.

1016-B

For detailed data — do this:

Write Dept. TE-258, The Bellows Co., Akron 9, Ohio (in Canada, Bellows Pneumatic Devices of Canada, Ltd., Toronto, 18) for Bulletin BM-25. Or, if you prefer, phone your Bellows Field Engineer—he's listed in the phone book under "The Bellows Co."

The feature of the integral valve brings important advantages. Installation is easier, electrical hook-up is simpler. It fits well in cramped quarters, or on moving machine elements. And of even more importance—the built-in valve means faster action, quicker response, less air consumption, and positive control over piston rod movement.

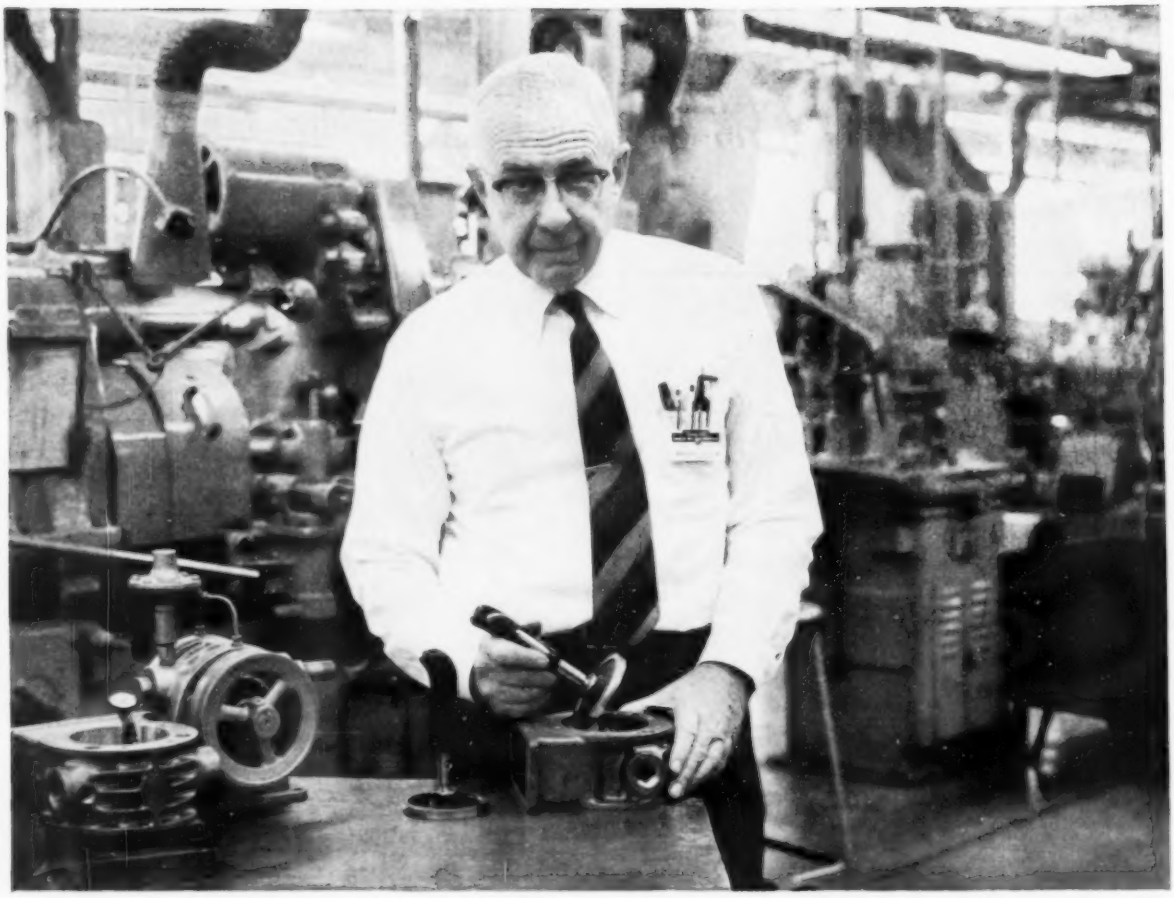
The Bellows Air Motor is made in five bore sizes: 1¼", 1¾", 2½", 3⅝" and 4½" and in any stroke length. You can have your choice of six different built-in valving arrangements, plus optional hydraulic piston movement stroke control.

*115 Volt for J.I.C. applications, if desired.

The Bellows Co.

DIVISION INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO

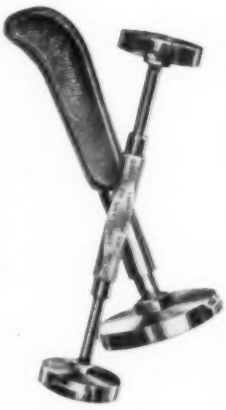


"DuBo plug gages used 10 years . . . good for 10 more!"

says Ed Clough, Plant Superintendent, GAST Manufacturing

GAST Manufacturing Corporation, Benton Harbor, Michigan, makes motors, compressors, vacuum pumps. This firm has used DuBo Plug Gages continuously since 1947 to check finish grind size on cast iron pump body parts.

Mr. Clough, Plant Superintendent, says: "We have just checked these gages for size and it looks as though they will be good for another 10 years. Formerly, we gaged with conventional plug gages and an allowance for checking was put in the grinding rate. The DuBo Gages are so much easier and faster to use no allowance is made."



This typical experience illustrates DuBo superiority over conventional plugs. DuBo gages last longer because there is practically no wear. In addition, DuBo is faster, easier to use, and detects faulty bore conditions other gages overlook—saving time and money while reducing false rejects to a minimum!

Ask the *Man from Standard* to show you the DuBo in his new do-it-yourself test kit.

STANDARD GAGE COMPANY, INC.
® SINCE 1925
POUGHKEEPSIE, N.Y.

A COMPLETE LINE OF GAGES . . . INDICATING, FIXED AND ADJUSTABLE TYPES

Bodine

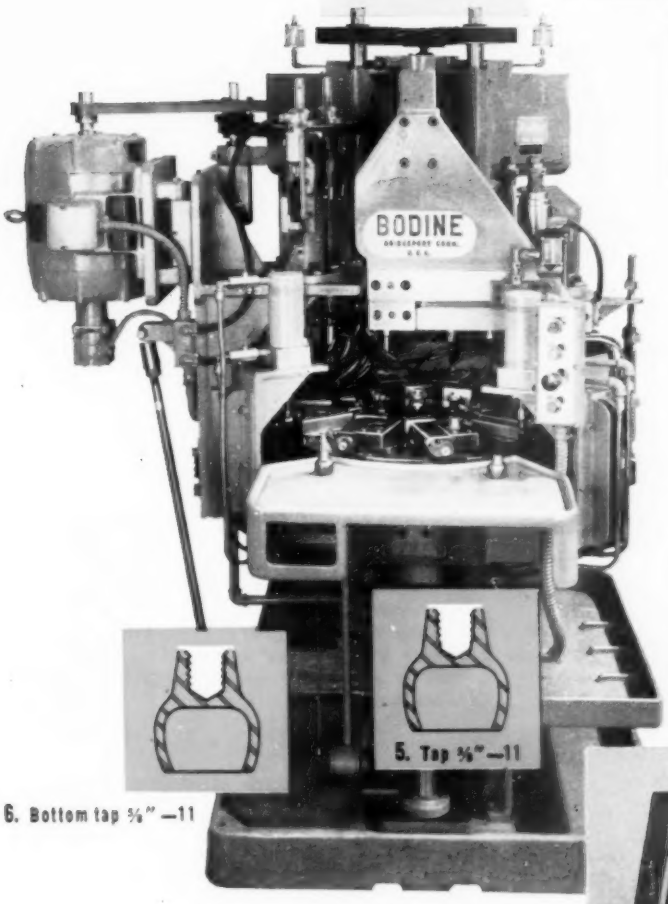
CASE HISTORY NO. 43
a high production success on a "heavy duty" job

Here's an interesting example of how the "extra capacity" built into a Bodine machine can sometimes be put to work very profitably. Ordinarily, ½" drill and tap capacity in steel is maximum for the Bodine 48-30, but in this case we are successfully handling 17/32" drills and ⅝"—11 taps in an SAE 1025 steel forging on a high production schedule.

Bodine Basic design provides the ample rigidity and mounting space requirements for separate high-power drill and tap spindle drives. Special centralizing clamping fixtures take care of the difficult work-holding problem.

Once again, this proves that the best way to approach any difficult production or combined production-assembly problem of this kind is to call Bodine first.

6 operations
600 pieces/
50 min. hr.



1. Spot drill and chamfer

2. Drill 17/32" —⅝" deep

3. Bottom drill 17/32" —¾" deep

4. Face top

5. Tap ⅝"—11

6. Bottom tap ⅝"—11

Write Dept. TE-2
for further information.

THE
Bodine
CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

Why the Contract Shop Owner Prefers PRODUCTO Die Sets

They help protect his profits

The contract shop owner prefers Producto die sets because they help protect his die performance...his delivery promises...his profits.

The shop owner favors Producto because he can choose from a wide range of die set styles and thicknesses in steel, semi-steel or a combination.

He knows that when his dies are mounted in Producto sets, they will retain the precision built into them. He can expect maximum die life, maximum production with minimum press downtime for regrinding.

The shop owner likes the fact that Producto offers him a choice of two classes of precision, and that *he pays only for the amount of precision he buys.*

He knows that whoever handles the die will spend the least possible time taking it apart and putting it together because Producto's Qwik-Fit Guide Pins minimize die set assembly problems.

Most important, the shop owner can depend on efficient Producto service and strategically-located Producto distribution centers to protect the delivery promises he makes to *his* customers.

When the contract shop owner thinks in terms of protecting his profits, he thinks of Producto die sets and accessories. You should, too.

NEW DIE SET CATALOG No. 11 is another reason the shop owner prefers Producto. It makes selection and ordering really easy. Write for your free copy today. And ask to receive Die Set Digest, too.

PRODUCTO

THE PRODUCTO MACHINE COMPANY
930 Housatonic Ave., Bridgeport 1, Connecticut

Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

NEW STARRETT DIAL INDICATORS AND GAGES

for guaranteed accuracy, long life, easy maintenance, low upkeep cost

Longer life for your dial indicators through high precision, low friction design that keeps them on the job . . . and lowest maintenance cost through simple interchangeable construction that cuts upkeep time to almost nothing. Easy-reading accuracy and smooth, consistent performance that makes your gaging program really work . . . plus the advantage of buying all your dial indicators and gages from one dependable source.

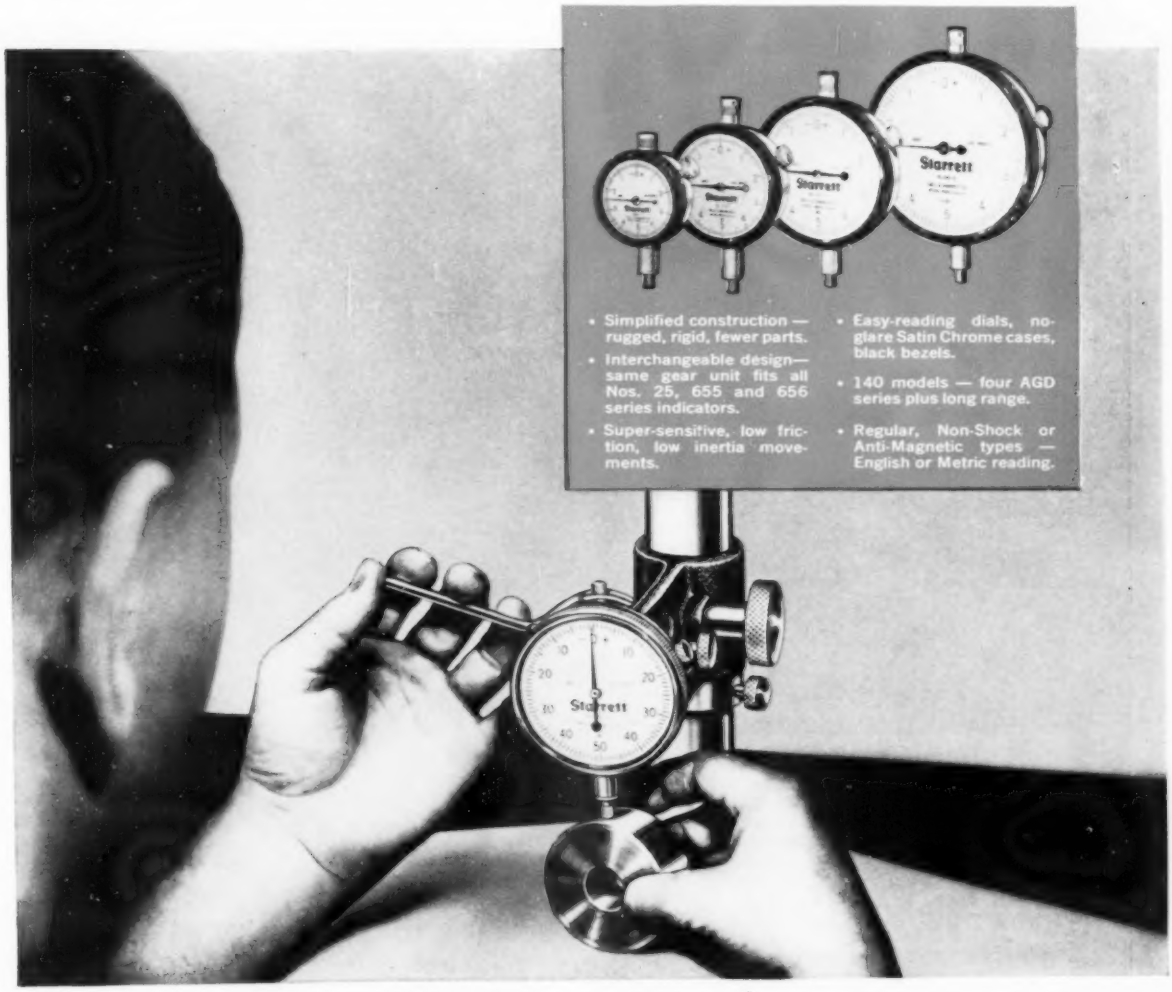
These are the benefits you get when you specify Starrett *High Precision—Low Friction* Dial Indicators —the world's most complete line. Your nearby Industrial Supply Distributor has them. Call him for quality products, dependable service. Or write for Starrett Dial Indicator and Dial Gage Catalog which shows the complete line. Address Dept. E, The L. S. Starrett Company, Athol, Massachusetts, U.S.A.

Starrett

DIAL INDICATORS and GAGES

World's Greatest Toolmakers

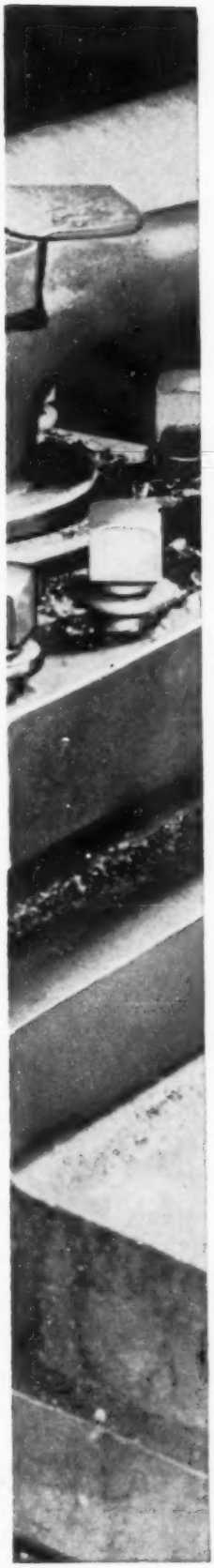
PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK • HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVE



STARRETT PRECISION MAKES GOOD PRODUCTS BETTER

Roughing and finishing this large motor shaft, a modified Standard Carboloy Tool (tipped with Grade 350) boosted the number of linear inches cut by 30% over other tools.

SETUP: **Material**—AISI 1045 modified (hot-rolled). **Speed** — 300 SFPM. **Feed** — 0.020 inch. **Depth of cut**—1/16 to ⅛ inch. **Coolant**—Yes.



3 reasons why industry specifies more Carboloy® braze-type tools than any other brand

1 Consistent, record-breaking performance

Tough jobs, like the one at left, are the real test of a tool's performance. And in plant after plant, Standard Carboloy Tools have proved that they deliver maximum production – at lowest cost per piece. They're made by the company that pioneered "standards." Their shanks are of the finest cold-drawn steel. Their carbide edges are automatically diamond-ground for accurate machining.

2 Complete range of styles, sizes, grades

Standard Carboloy Tools are available in thirteen styles, hundreds of sizes. Used "as is" or adapted to specials, they can handle up to 80% of all single-point jobs – from rough turning to precision threading. They're available with tips of Carboloy Extra-Performance steel-cutting grades 330, 350, and 370. Or, with carbides for cast irons, super alloys, nonferrous and nonmetallic materials.

3 Immediate delivery from local stocks

There's no waiting for "long distance" delivery when you order Standard Carboloy Tools. Authorized Distributors of Carboloy cemented carbides in 140 cities keep full stocks on hand for off-the-shelf delivery. Your local Carboloy Distributor is listed in your Yellow Pages. Call him today. Or write: *Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Ave., Detroit 32, Michigan.*

CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC

This shows one of 34 holes being tapped in the ram body for a hydraulic servo that is part of the MB-3 autopilot installed in the F-100.

BATH
SPIRAL POINT
GROUND THREAD
TAP

for the best buy ...buy Bath

Another Bath Tap job well done!

Reduces cost per tapped hole for Minneapolis-Honeywell

HONEYWELL

At Minneapolis-Honeywell, Aeronautical Division, the production of tapped holes in intricate and expensive parts is an important requirement.

Honeywell engineers approached this problem from the viewpoint of "cost per tapped hole", the only sound evaluation of tap economy.

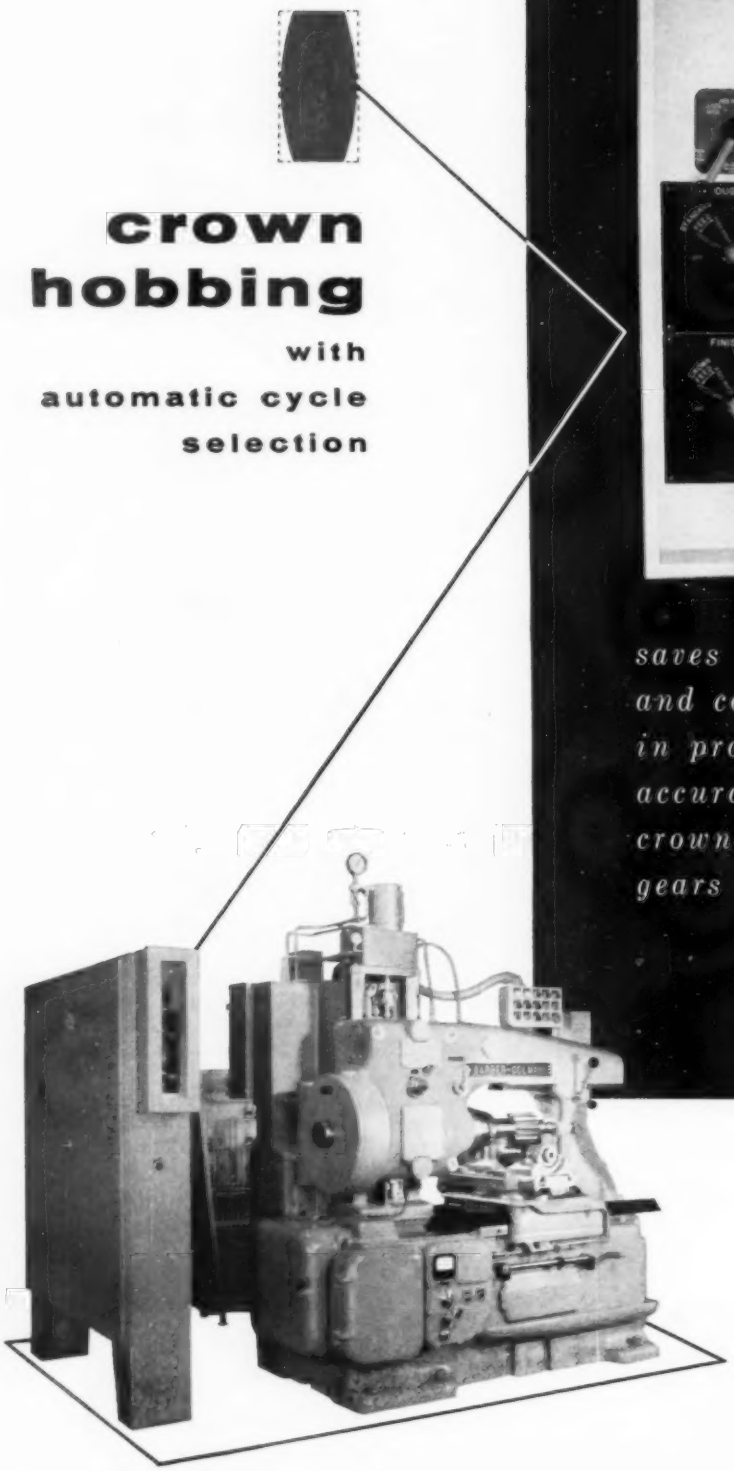
Bath engineers and the Bath distributor co-operated and Bath was selected as a major supplier. They accomplished a SUBSTANTIAL SAVINGS that not only reduced the cost per tapped hole — but also established a higher degree of operating performance.

Although you may not have these exacting requirements in tap procurement, or the volume production to make such a depth of inquiry feasible, Bath taps will prove most economical for you too, as demonstrated many times in high production plants.

JOHN BATH & CO., Inc.
28 Mann St., Worcester, Mass.

CYLINDRICAL AND THREAD GAGES · GROUND THREAD TAPS · INTERNAL MICROMETERS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 2 63



crown hobbing

with automatic cycle selection

saves time and cost in producing accurately crowned gears

Fairfield Manufacturing Company, LaFayette, Indiana, is crown-hobbing coarse pitch pinions on this special Barber-Colman No. 14-15 Hobbing Machine. Crown-hobbing is a new method for generating crowned gear teeth. Whether shaving is required after crown-hobbing depends solely upon the finish required. If the hobbed finish is satisfactory, shaving can be eliminated. If shaving is required to produce the desired finish, crown-hobbing allows uniform stock removal by the shaving cutter, resulting in reduced production time and increased shaving cutter life.

This machine, especially designed and built for crown-hobbing, may also be used for standard gear hobbing. A choice of automatic cycles is available through settings on the control panel, including hobbing at constant depth and finish crown-hobbing, rough and finish hobbing without a crown, or single cut hobbing with or without a crown, feeding either left or right with climb or conventional cutting.

On the job shown here, Fairfield Manufacturing Company is crown-hobbing 3 D.P. pinions, 14T, 20° P.A., with 5½" face and .008" change in tooth thickness. The automatic cycle includes rough hobbing at constant depth and finish crown-hobbing. In cycling, the machine completes the conventional roughing cut, work slide raises, hob returns to starting position, and work slide lowers to finished depth against the crowning cam. The gear is crown-hobbed at a constantly changing depth, as controlled by the crowning cam, work slide raises, hob returns to starting position, and cycle stops for reloading. Cycle pattern and type of feed are selected by levers on the control panel as shown.

The machine may be designed to suit special job requirements, either as a single-purpose machine, or with the universal feature, as in this case, for both crown and standard gear hobbing. A cam and change gear mechanism for crown-hobbing is provided in the design of the machine for raising and lowering the work slide during the cycle to produce a change in tooth thickness. The work slide is held against the rotary cam by hydraulic pressure in addition to its own weight. Change gears are provided in the cam drive so that different amounts of change in tooth thickness can be produced with the same cam. Different cams can be designed when a different tooth crown configuration is required.

Crown-hobbing also makes it possible to hold a change in tooth thickness within the desired limits, and the tooth bearing can be located at the most desirable point consistent with job conditions.

We welcome your inquiries on crown-hobbing and suggest you send us drawings of your crowned-gears. Our engineers will analyze the job conditions and make recommendations for crown-hobbing. If analysis shows a practical application for crown-hobbing, we shall be glad to cut samples in our laboratory for your approval.

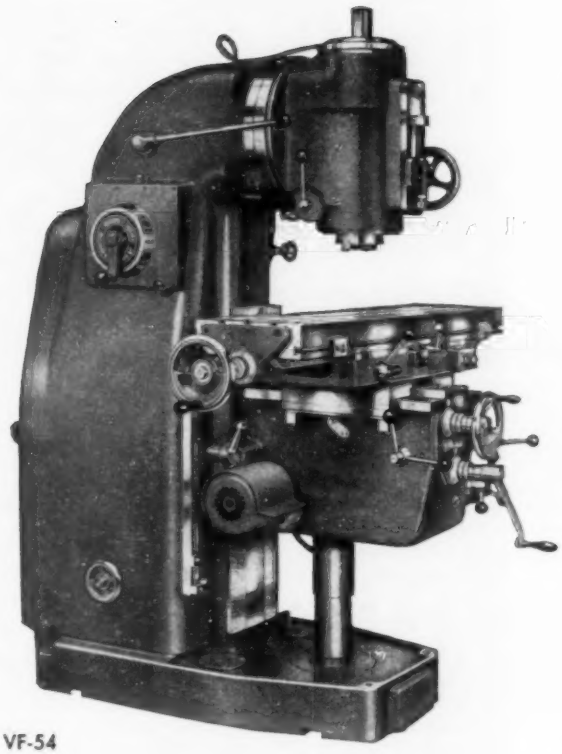
Putnam takes the shank off the end mill . . .

. . . puts it on a holder that soon pays for itself.

Eliminate integral tapered shanks and cumbersome tool changing on heavy end mill jobs with the new, proven Postiv-Lok end mills. They'll cut your end mill costs up to 25%, give smooth, chatter-free cutting through torque-aided locking. Write for catalog on your letterhead.

Postiv-Lok adapters simplify change-over to small end mills, shell end mills and drills.

PUTNAM
TOOL COMPANY
2981 CHARLEVOIX AVE. • DETROIT 7, MICH.



VF-54

ONLY SWEDISH CRAFTSMEN

Can Build These Precision Millers At Such Surprisingly Low Cost

HORIZONTAL AND VERTICAL SAJO MILLERS

Built to U.S. Standards, Sajo Millers with proven production records in modern industry are available in both plain and universal models. Installation references in your vicinity on request.

Standard Duty #2 (Model 54)
ALL GEARED Millers—

Plain, Universal and Vertical—table 52" x 11", 7½ HP with power feeds (longitudinal 33½") and power rapid traverse.

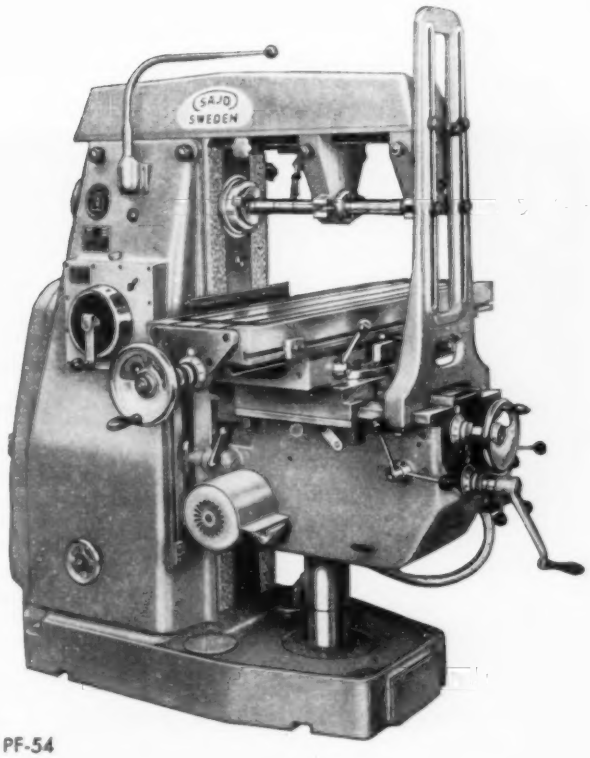
•

Light Duty #2 (Model 53)
ALL GEARED Millers—

Plain and Universal—table 41⅜" x 9¼" —3½ HP with power feeds (longitudinal 24½").

Light Duty #2 (Model 48)
Utility Millers—

Plain and Universal—table 41⅜" x 9¼" —3½ HP with power feeds (longitudinal 24½").



PF-54

austin INDUSTRIAL CORPORATION

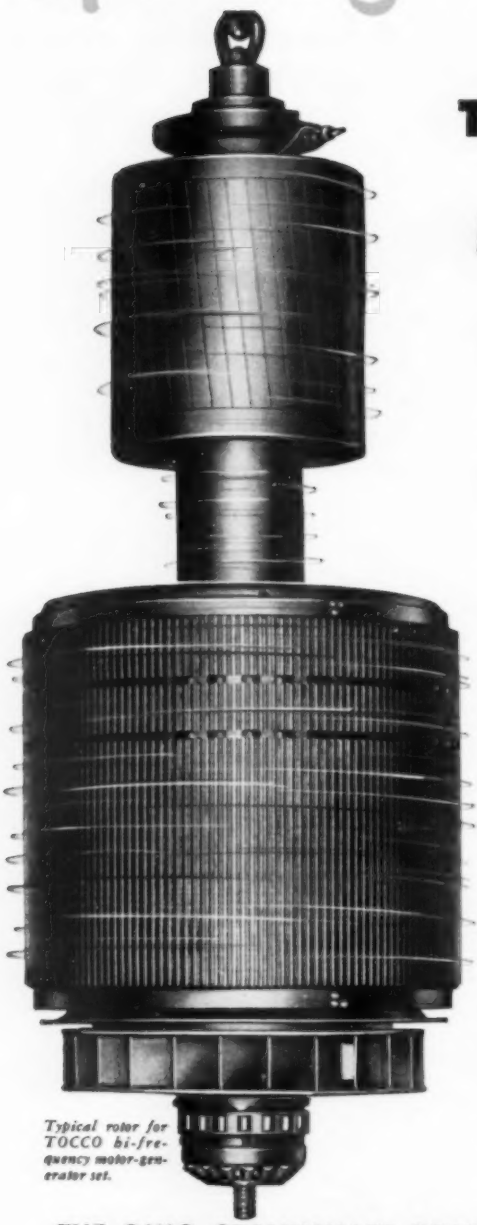
76-V MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

HORIZONTAL AND VERTICAL SHAPERS • POWER HACKSAWS

FAST SERVICE AND PARTS AVAILABLE FROM MAJOR CITIES, WRITE FOR CATALOGS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-67

Spinning for over 15 Years!



Typical rotor for TOCCO hi-frequency motor-generator set.

TOCCO'S VERTICAL
Hi-Frequency
Motor-Generator Sets

First with Vertical MG Sets—TOCCO*

In 1943 TOCCO designed and built the first vertical motor-generator sets for furnishing hi-frequency power for induction heating applications. Now with fifteen years of continuous production experience, we are far and away the world's largest supplier of these units. Over 1000 are now in service.

Advantages of TOCCO Vertical MG Sets

The large TOCCO vertical type motor generator set has numerous advantages over conventional horizontal type sets. Vertical construction permits the use of very large bearings and also minimizes the hazard of major damage to the set in the unlikely event of a bearing failure. Longer bearing life is achieved due to lower pressure and uniform loading of the bearings. Maintenance is greatly simplified because the rotor can be removed vertically with a simple hoist. Anti-vibration mountings between the base and the MG rotor-stator assembly practically eliminate vibration. No special foundations are needed. Lastly, TOCCO's vertical design cuts necessary floor space to less than one-half the area required by horizontal motor-generator sets.

TOCCO vertical MG sets are available in sizes up to 350 KW and frequencies from 1000 to 10,000 c.p.s.

Only Time-Tested Vertical MG Sets—TOCCO

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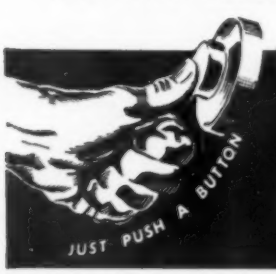

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Engineering Progress

The week of February 16 has been set aside to pay tribute to engineers. Our highest praise goes to the National Society of Professional Engineers for its part in organizing this National Engineers' Week and to the founding societies for their foresight and diligence. These societies have been responsible for continuous improvement in our standard of living.

We of the American Society of Tool Engineers would like to pay our finest and most sincere tribute to those who have devoted their lives to a profession that has given us so much for which to be grateful.

The members of the National Education Committee of the American Society of Tool Engineers are constantly seeking, throughout the society, those members who are eligible to become registered engineers. This practice is not only beneficial to the members themselves, but also has its effect on the society as a whole. It is only fitting that the prestige of the society is continually elevated through our efforts to improve ourselves individually.

The success of the National Engineers' Week is assured, because of the many thousands of engineers, who by their own profession, have assured us of a higher standard of living on earth. It is our sincere wish that all American Society of Tool Engineers chapters will continue to contribute to the success of the National Engineers' Week.

H E Collins

PRESIDENT
American Society of Tool Engineers

WHAT'S AHEAD...

in steel service and supply

New Steels—1958 will peak 1957 by the addition of scores of new sizes and types of steel. Stocked for ready shipment from strategically located Ryerson plants are such new products as:

- **Pre-painted Steel** . . . cold-rolled coils, in color choices, widths from ¾″ to 42″, gauges .006″ to .035″.
- **New Tubing** . . . hot finished carbon steel in wall thicknesses up to 1½″, O.D. sizes up to 12¾″.
- **Alloy Rebars** . . . reinforcing steel with high-yield point for space saving.
- **Alloy Plates** . . . hot rolled 8620 in 16 sizes, and hot rolled annealed 4140 in 19 sizes, thicknesses up to 5″, widths up to 84″.

These represent only a sample of the many additions in stock . . . and coming during 1958.

New Quality Safeguards—Already known for controls that protect you on every purchase, Ryerson is further revising and tightening its quality control program across the entire range of products. For example, new closer cutting tolerances are being established; specifications are being reviewed, and all phases of Ryerson service are being more exactly tailored to your needs.

Stepped-Up Service—To meet growing demand, new Ryerson plants have just been opened at Indianapolis and Charlotte . . . modernization and expansion programs are completed or under way at Los Angeles, Pittsburgh, St. Louis, Buffalo and Spokane.

1958 promises steel users further improvements in Ryerson plants and facilities. Delivery records, such as shipping five out of every six orders within 24 hours, and 60-minute emergency order handling will continue to assure you of getting exactly what you need *when* you need it.

As close as your telephone, you'll find a wider range of steel stocks . . . controlled high quality . . . dependable service that goes beyond the material itself. So, as you look ahead into 1958, it will pay you to include Ryerson in your plans.

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Principal Products: Carbon, alloy and stainless steel—bars, structurals, plates, sheets, tubing—aluminum, industrial plastics, metalworking machinery, etc.

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INDUSTRY'S Responsibility for more engineering graduates

By Chester Linsky*

Associate Professor
Dept. of Industrial Engineering
Pennsylvania State University

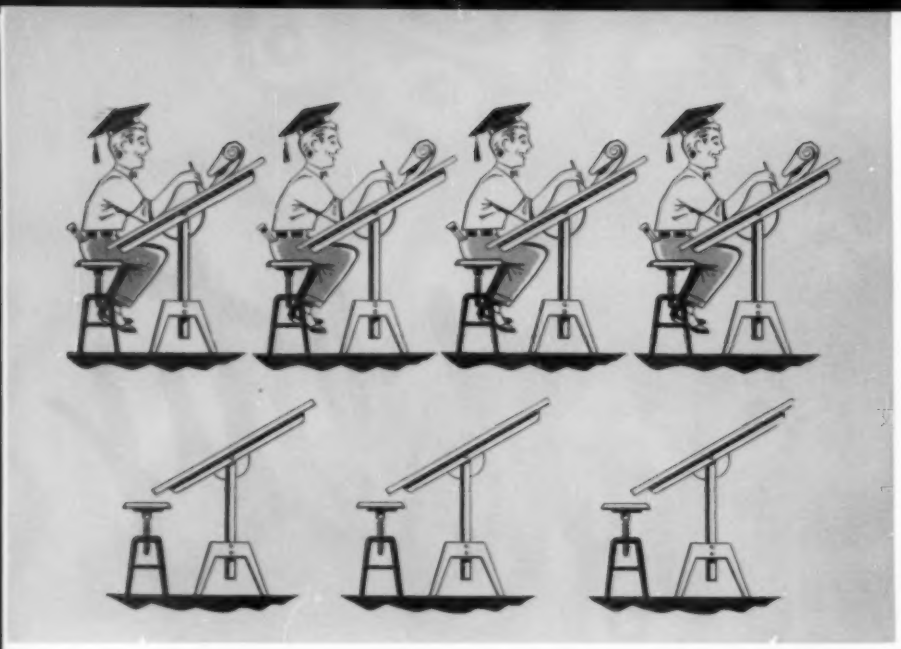
Industry can help to alleviate the shortage of engineers by a program of positive aid to engineering schools. The author, who is widely known as a teacher and as the founder of the Penn State Automation Seminars, gives his personal views as to how and where such aid should be administered.

DURING JUNE of last year, approximately 24,000 students were graduated from engineering colleges. It has been estimated that there were 42,000 jobs waiting for them to fill. Simple arithmetic shows that 18,000 of these openings were not filled.

This shortage of engineering graduates has had considerable impact on American industry. Companies engaged in defense work, for instance, could easily have absorbed all June engineering graduates. Manufacturers of consumer goods found the shortage equally frustrating. Untold numbers of potentially marketable products are still in the idea stage because there just isn't enough engineering talent—research, product design and manufacturing engineers—to permit adequate product and manufacturing development.

In the face of an accelerating demand for engineering graduates, engineering schools are forced to severely limit their enrollments. Engineering schools could accommodate more students if all of their facilities and staff were devoted solely to direct education. Basic engineering research programs are, however, an important function of many engineering

*Member-at-Large



In June of 1957, there were only four engineering graduates for every seven job openings in industry.

schools and it is doubtful if any university would consent to a reduction in research. The other means of increasing the number of engineering graduates is to add teaching facilities and staff.

This takes money. Federal aid—one possible solution to the financing problem—has met with resistance from engineers and representative engineering and technical societies because of the possibility that such assistance would ultimately lead to federal control of engineering education. Whether a federal aid program can be realistically and efficiently operated, should it ever materialize, is also something to be considered. State and local aid for engineering schools cannot be expected to increase. Available local funds for education are allocated among many schools and, because of the continuing demand for economies and tax relief, these funds are limited.

Since increased government aid may not be the answer, other means must be found to finance expansion of engineering schools. Industry itself, by far the largest employer of engineering graduates, should be prepared to take concrete action to increase the number of graduate engineers.

At first glance, industry aid to engineering schools appears to be an expensive undertaking. The present situation can, however, be improved at little additional cost if industry knows how and where to invest in educational programs to net the greatest returns. In studying the problem, industry and the schools must cooperate more closely than they have done in the past.

Recognizing this need for close cooperation, the most direct approach to the problem is to determine:

- What engineering schools need for the type of job industry wants them to do
- What industry is doing today to aid engineering education
- How the two can be equated to get the job done with minimum additional expense.

Each of these points will be separately considered.

What Engineering Schools Need

Since World War II, millions of dollars have been poured into engineering education facilities. In many cases, however, facilities are still far from adequate. Physical plants of some institutions are obsolete. Much laboratory equipment is old, in short supply, and beyond the state of economical—or possible—repair. Classroom and laboratory space is limited and, at least in some schools, faculty members share crowded offices.

Obviously, inadequate facilities make it difficult to accommodate even the present number of students. Facilities expansion is an urgent need if engineering schools are to graduate more students.

A second requirement is larger teaching staffs. With the relatively high salaries offered to promising engineers by industry, attracting and holding large staffs made up of high-caliber individuals is something of a problem. Many engineers feel that they simply cannot afford to enter the teaching profession. This new blood, however, is important to the success of any institution, whether it is a school or a business. Young, well-qualified and experienced men are required in sufficient numbers to replace those who retire, to allow expansion and to provide technical knowledge and skills in those newer fields of engineering that are commanding so much more of the practicing engineer's time. Better pay helps to attract such individuals.

Equally important are such morale-builders as newer and more adequate facilities, opportunities to keep abreast with current technology and concrete recognition of the important role played by the engineering educator in developing qualified graduates in adequate numbers. Morale is, of course, the result of many factors, tangible and intangible. Unless it is kept at high levels, a teaching staff may disintegrate.

How Industry Aids Education

Over the years, many corporations have given generously to engineering education. While industry aid varies from institution to institution, every school receives some form of assistance. Specific statistics relative to the assistance being received are not available; however, it is possible to list some of the forms this assistance takes, as shown in the accompanying table.

To show how these contributions have aided the development of sound engineering programs, make a mental note of two or three schools with standout reputations for their engineering programs. The premium that industry is willing to pay for their graduates is testimony to the quality of their engineering programs. These schools have high salary structures that enable them to draw upon the top men in engineering education. For many of these men, the prestige of associating with other outstanding teachers, use of excellent laboratory and teaching facilities, and the opportunity to undertake adequately supported research, outweigh salary considerations. Much of the success of these schools has been made possible by direct and indirect assistance from industry.

Budgets: In making out annual budgets, funds must be distributed in terms of priorities to keep the school's over-all program going. Frequently, budget decisions are hard on everyone. Some of the more typical questions are:

- Should money be spent on needed laboratory facilities or new research programs or should it be used for well-deserved salary increases?
- Should certain staff members be transferred from research to full-time teaching?
- Should funds be allocated for replacing worn-out laboratory equipment, or should they be spent for token salary increases?
- Should faculty allowances for business trips be increased or should this money be spent for badly needed office equipment?

Any type of direct assistance, even when it is for a specific purpose such as a new building, makes it possible to divert funds for salary increases, research programs or dozens of other worth-while activities.

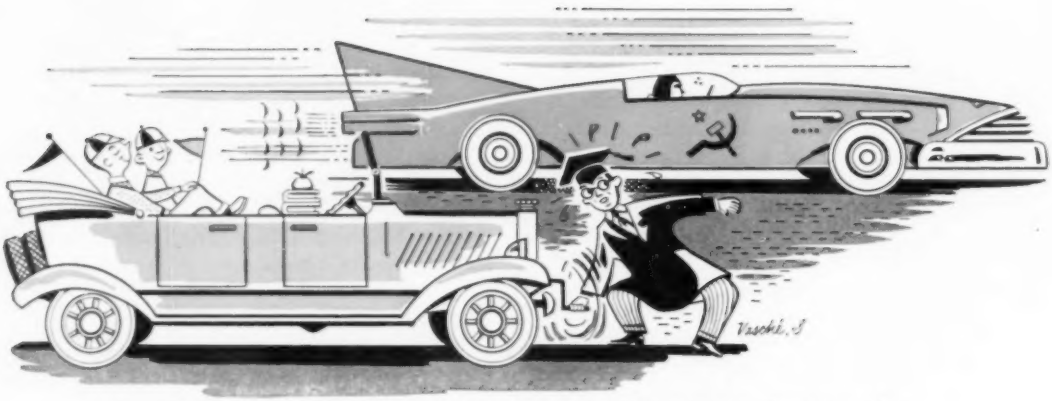
Industry-supported research programs and contracts, like contributions for buildings and facilities, are extremely helpful in equipping laboratories and attracting outstanding personnel. This assistance frequently makes it possible for graduate programs to survive.

Graduate programs are among the best sources of new personnel and they open up avenues for good working relations between the engineering school and the cooperating company. Further, they provide the faculty with an opportunity to keep abreast of new techniques that can be applied in laboratories and classrooms.

Scholarships, loans and similar indirect aid from industry are primarily of benefit to students. Properly organized and conducted plant tours are especially valuable. There is a great difference between purely experimental setups found in a school laboratory and an actual piece of equipment operating under plant conditions. An afternoon spent in a plant or industrial laboratory under the guidance of men who can provide specific answers to questions

HOW INDUSTRY AIDS ENGINEERING SCHOOLS

Direct Assistance	Indirect Assistance
BUILDINGS	FACULTY
EQUIPMENT	Summer employment
Laboratory	Technical help
Research	Technical literature
Special products	Plant tours
SALARIES	Part-time employment
Salary improvement	Consulting opportunities
Slush funds	Sabbatical employment
FUNDS	STUDENT
Fund-raising campaigns	Scholarships
General-purpose cash donations	Loans
Endowments	Summer employment
PHYSICAL ASSISTANCE	Fellowships
Use of plant facilities	Cooperative employment
Fabrication of special equipment	MISCELLANEOUS
RESEARCH	Films
Grants and subsidies	Catalogs
Contracts	Speakers
FACULTY ASSISTANCE	Course development help
Endowed chairs	
Loan of employees	
Special demonstrations	
Resident graduate and research work	



Many schools are forced to teach with obsolete equipment, sometimes beyond the stage of possible or economic repair. Industry help is needed.

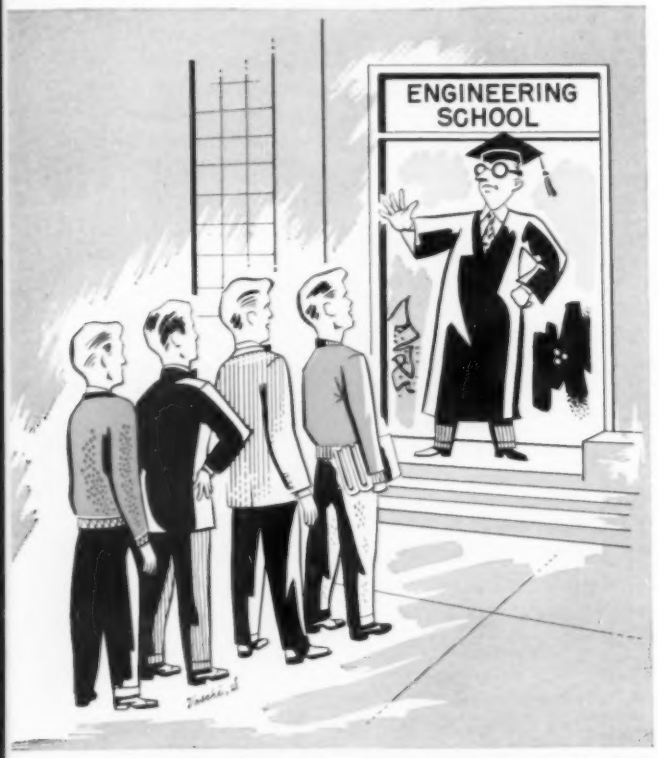
gives a course a realistic flavor. Films, catalogs and speakers from industry also help to stimulate interest.

Making Aid Really Count

From the standpoint of correcting the shortage of engineers, industrial contributions do not always give an adequate return. The average business organization does not always appreciate where its dollars and other contributions are most urgently needed. To obtain an increased number of graduate engineers, present aid policies must be revised. In place of the present informal and haphazard contributions, management will need to develop a more formal and businesslike arrangement. Seven ground rules should be observed:

- Companies that want engineering graduates must be willing to assume responsibility for aid to schools
- Aid to engineering schools should be considered as an investment with funds budgeted accordingly
- Funds should be applied where they will do the most good toward alleviating the shortage of engineers
- Formal policies for handling company aid to engineering schools should be established
- Distribution of financial assistance to engineering schools should be made primarily in proportion to the number of graduates the company hires
- Engineering schools should be the sole judges of their own needs
- Companies should in no way interfere with or attempt to influence a school's internal policies unless specifically requested to do so.

These rules will be discussed in turn.



Engineering schools are forced to drastically limit their enrollments due to limited staffs.

Paying for Engineering Graduates: To a certain extent, industry has been paying for the engineering graduates it hires for several years. Judging from stepped-up campaigns to recruit engineering graduates, industry will no doubt be spending even greater sums in the immediate future. Often, plant managers, chief engineers and other top executives accompany recruiting teams. The engineering manager of a large division in one of the country's larger corporations has stated that he now spends as much as 40 percent of his time in recruiting trips and in plant interviews. Considering this cost in money and time, it is apparent that industry has already adopted the principle of paying for the engineering graduates it hires. Unfortunately, this recruiting does not increase the number of available graduates. The same amount of money, in-

vested in engineering education, would pay much larger dividends in terms of qualified engineers.

An example of recruiting costs is furnished by one large midwestern university that has 2500 engineering students, with 700 enrolled in the department of mechanical engineering. This department, with a 40-man staff, graduated 225 students last June. Each student received four job offers, on the average. He was interviewed seven times and made four trips for in-plant interviews. The average cost to the individual company for transportation, food, lodging, entertainment and engineering staff time amounted to around $250. In terms of direct expenditures, a total of $56,250 could easily have been spent just to bring the students in for interviews. Only one out of four students so interviewed took a job with the company that paid their expenses.

With improved recruiting and selection, this expense item could be cut in half. If it were possible to apply the saving towards improving the department's staff, five or six additional staff members could be hired. This would increase the number of graduates by as much as 15 percent.

Engineers as an Investment: Once a company accepts financial responsibility for the training of its future engineers, some basis for determining how much the company should invest must be worked out. No general guide can be established. Each company must determine the amount per graduate it can invest and the total number of graduates it will require, based on anticipated growth and normal personnel overturn.

The urgency of a company's engineering manpower shortage will naturally govern how far it is willing to go towards underwriting the costs of providing more graduates. Where a definite urgency exists, it is to the company's advantage to establish a policy of investing where it will do the most good.

In many cases, a company's historical pattern of contributions to education may have to be changed. For example, investments in engineering school facilities and staff improvements can prove to be wiser than investments in scholarships, research fellowships and grants. While scholarships are a financial blessing to some students, the student who really wants an education can find many ways to pay for it. There is statistical evidence to show that recipients of scholarships do not necessarily go to work for the company that provided funds for their education. With these facts in mind, some companies that have traditionally awarded scholarships are now investing an equivalent amount of money in laboratory and teaching equipment, benefiting all students, rather than a few.

Scholarships and cash prizes available in the mechanical engineering department of one university total over $7000 annually. With this amount of money an additional staff member could be hired. At the current ratio of one staff member to every six students, the department's graduate potential would be increased by six students.

Formal Aid Policies: Distribution of grants and gifts can take months in the absence of company policies covering aid to education. Some of the factors that should be considered in developing such a policy include:

- The type of aid the organization will give
- Limits on aid to any one school
- Channels company will use to distribute aid
- Priorities and other basis for distribution of aid
- Ways of announcing availability of surplus property.

Primarily, aid should be directed towards helping

Plant managers, engineering managers and other top executives accompany recruiting teams for engineers.

to improve teaching facilities, staff salaries and the size of the staff.

One type of aid is in the form of direct payments to the engineering school department that trained a new company employee. Contributions of several hundred dollars per student could help to defray the department's operating expenses and provide a direct incentive for everyone to work harder to increase the number of graduates. Such a plan is already in operation in one school with payments of as much as $600 per student being made.

costly, yet it can make a big difference to a school with limited resources.

Many companies have surplus equipment that could be put to good use in engineering schools. Such equipment can be turned over to a school as an outright gift or on a long-term loan basis. The book value loss may be offset by savings in storage, insurance and tax costs.

Companies that are considering the gift or loan of equipment to engineering schools should develop some means for announcing the availability of such

Companies should not concentrate their aid on certain favored schools.

Industry can also take direct action to improve faculty salaries. Many universities have "chairs" sponsored by corporations or individual donors. The cost of this publicity is relatively low. Local trade and manufacturing associations sometimes subscribe to "slush funds," apportioned to faculty members on a "most-deserved" basis.

Another way to improve salaries is to provide opportunities for paid on-campus research work. Hiring teachers for part-time consulting work benefits both faculty members and industry. Summer employment pays similar dividends. It is also an excellent method of helping faculty members to keep abreast of current developments in their fields.

There are many other possibilities for aid to schools that should not be overlooked. For example, most large organizations have office service groups, which could assist the schools by running offset printing and photographic work. Company toolrooms and service shops could fabricate special parts for use in school laboratories. Loan of special apparatus, when schedules permit, will eliminate the need for a school to buy its own unit. When judiciously applied, this kind of assistance need not be

equipment. Information as to the type of equipment, age, condition, location and availability is of great help to potential users. The book value and any costs required for rehabilitation and shipment can be applied against future financial allocations to the school.

If an effective distribution of assistance is to be assured, some limit on the amount of aid given by a company to an individual school should be established. By distributing aid over a large number of schools, a company gains the advantages of closer working relationships with all of them and may find itself in a more favorable position when hiring engineering graduates. The more equitable the distribution, the more favorable the prospects of putting the aid to work where it will net the greatest possible returns to everyone concerned.

To make an aid program operate as smoothly as possible, it is necessary to establish channels for the distribution of aid. This helps to eliminate delays pending a decision relative to who is to approve a donation. It also answers such questions as how the schools should make their needs known and how the distribution of specific grants can be expedited.

Judging the Need for Aid: The colleges are the best judges of their own needs. They know where a particular piece of equipment can best be used, where a cash donation will do the most good and what priorities they must consider in solving their own operating problems.

Perhaps the soundest and fairest way to determine which schools are deserving of aid from a particular company, and in what amounts, is to base the decision on the number of graduates of each school hired by that company. This is a direct and equitable way of paying for engineering graduates.

Under a program of partial underwriting, the schools must be given the prerogative of deciding what assistance is most needed. For instance, a company that plans to dispose of laboratory equipment may decide to give it to one of the universities from which it recruits students. Even though the equipment is in first-rate condition a university may have to turn it down because it has no valid use for it, can't find space for it or already has similar equipment. A valuable gift is difficult to turn down, especially when the potential recipient knows that the donor might be offended by the refusal. The possibility that such situations arise must be recognized by industry when making plans to help engineering schools improve their productivity. Where dealings are conducted on a frank and sympathetic basis, both parties will benefit.

Determining where help is needed and what type of help is needed is not difficult when lines of communication between industry and schools are kept open. Some possible means of communication are:

- Periodic statements of needs from engineering schools
- Periodic surplus facility notices to the university
- Coordination of aid through professional engineering societies
- Direct contacts between specific departments and industry
- Contacts with university placement directors
- Liaison with university "fund officers."

As individual companies and schools become better acquainted with each other, other lines of communication, often informal, can be worked out.

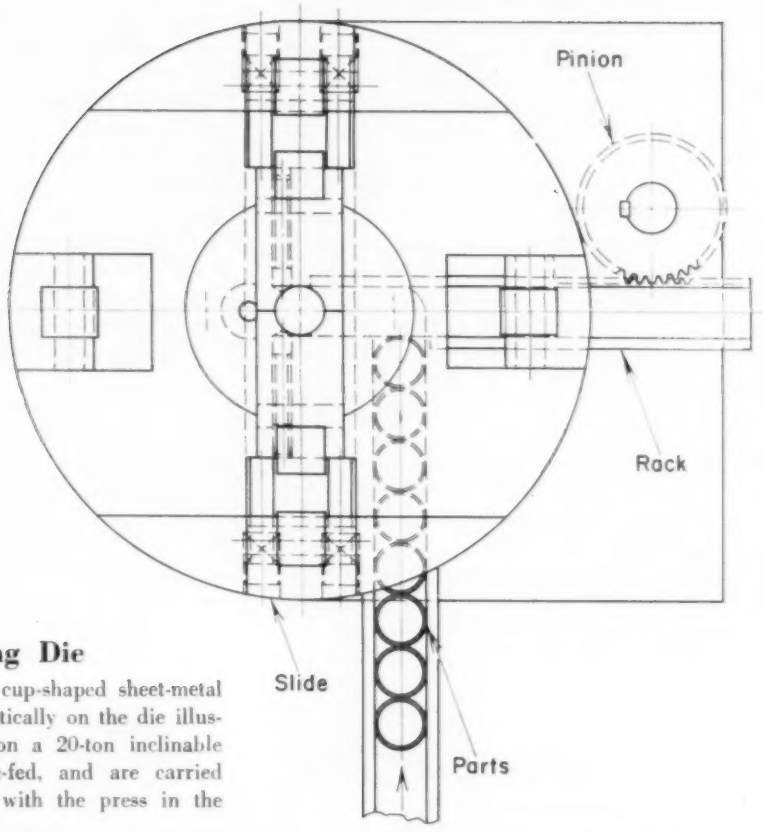
School Policies: The fact that company funds are invested in a school does not confer the right to interfere with the school's internal policies. Interest in a school's program is one thing; interference is another. No company can operate for the benefit of a particular customer and certainly no school can operate for the benefit of one company. There are, of course, times when assistance in shaping policies and programs will be requested. This kind of cooperation is of mutual benefit to schools and industry.

Up to this point, the responsibilities of industry to the engineering schools have been emphasized. It should be pointed out that schools have definite responsibilities to see that aid is used wisely. Both industry and the schools have a common objective—increasing the number of qualified graduates—and, in the final analysis, it is up to the schools to provide sound administration of funds and effective instruction. This is the key to getting more out of aid provided by industry.

Higher faculty travel allowances for professional conferences and business trips would improve morale.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work



Automatic Trimming Die

Trimming operations on cup-shaped sheet-metal parts are performed automatically on the die illustrated, which is mounted on a 20-ton inclinable press. Parts are magazine-fed, and are carried down a chute by gravity, with the press in the inclined position.

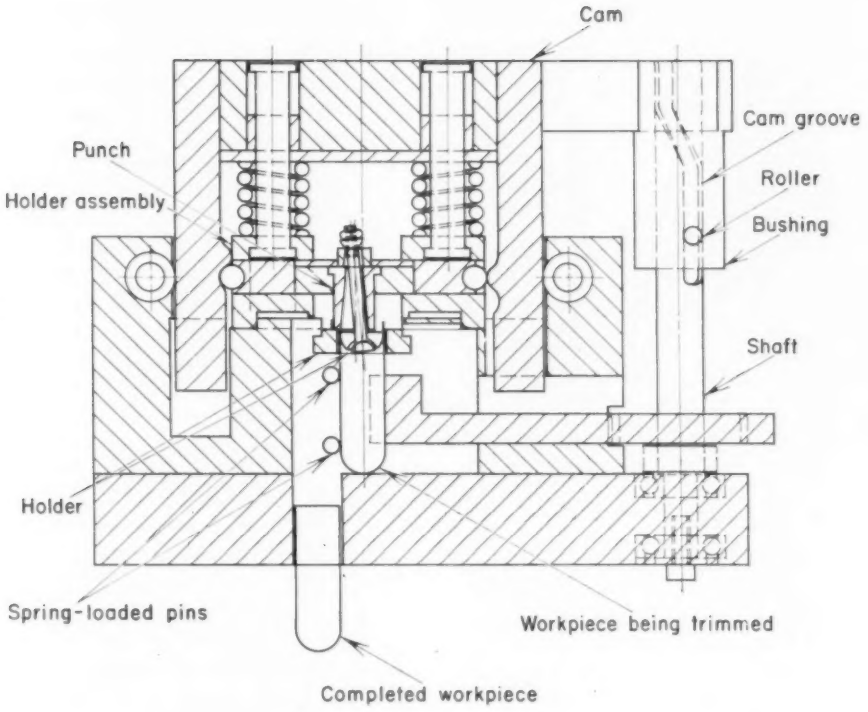
As the die is operated, the lead part comes to a stop against a feeder arm. On the upstroke of the press, the feeder arm is withdrawn by a rack-and-pinion movement, allowing the part to move into position for feeding. This movement operates as follows: the pinion is attached to a shaft actuated by a cam roller. The roller is attached to a bushing which slides up and down on the shaft with the upper die section. A cam groove in the shaft accommodates the roller; thus the up-and-down motion of the bushing is converted into rotational motion of the pinion.

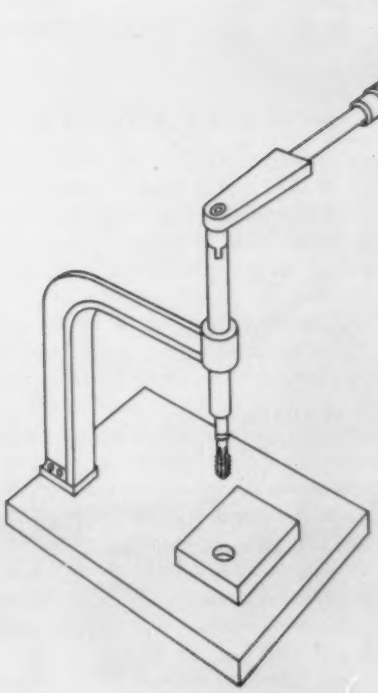
On the downstroke of the press, the feeding arm pushes the part into position for trimming. Two spring-loaded pins hold the part vertical at this time. As the ram continues to descend, a holder assembly is brought into contact with the lower section of the die. A cam assembly, mounted on the holder assembly by pins, continues to descend, maintaining spring pressure on the holder assembly. The four cams in the cam assembly successively actuate slides in the holder assembly. Two slides hold the part and four slides move the punch. The in-and-out motion of the latter four slides moves the punch, thus trimming the part.

When the ram goes up, the feeder arm is retracted and trimmings are blown off the die by air pressure. As the ram starts down, the new part pushes the trimmed part off the trimming position so it falls through a hole in the bottom section of the die. A blast of air helps to remove the part from the die.

This type of die is especially suited for installation in automatic press lines. Production rates of 3600 parts per hour can be attained.

G. W. Lateste
Santa Clara Chapter

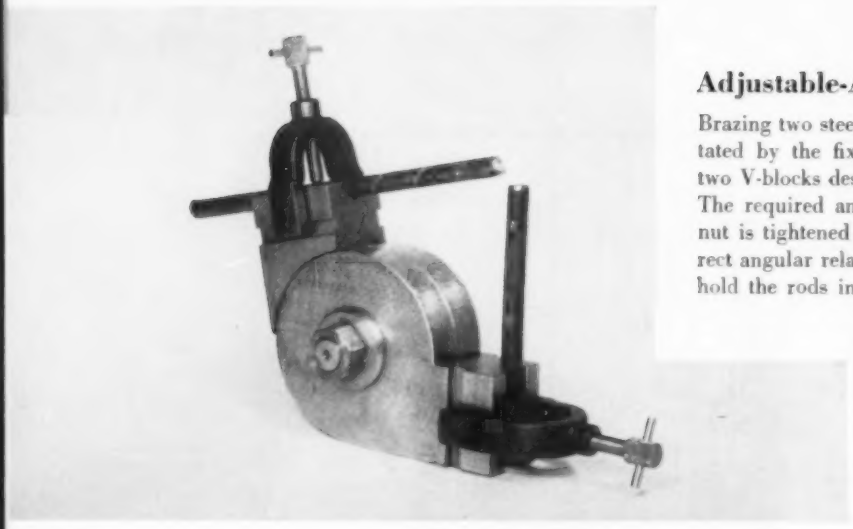




Torque Handle for Hand Tapping Machine

Most hand tapping machines are equipped with a crank for rotating the tap. The machine illustrated has been equipped with an adapter to permit use of ratchet type hand torque wrench in place of the crank. The ratchet is convenient to operate and the controlled torque minimizes tap breakage.

Henry Koslow
Bronx, New York



Adjustable-Angle V-Block Fixture

Brazing two steel rods together at an angle is facilitated by the fixture illustrated, which consists of two V-blocks designed to pivot on a common shaft. The required angle is set with a protractor and a nut is tightened down to hold the V-blocks in correct angular relationship. Standard V-block clamps hold the rods in position.

H. B. Wilder
Montreal Chapter

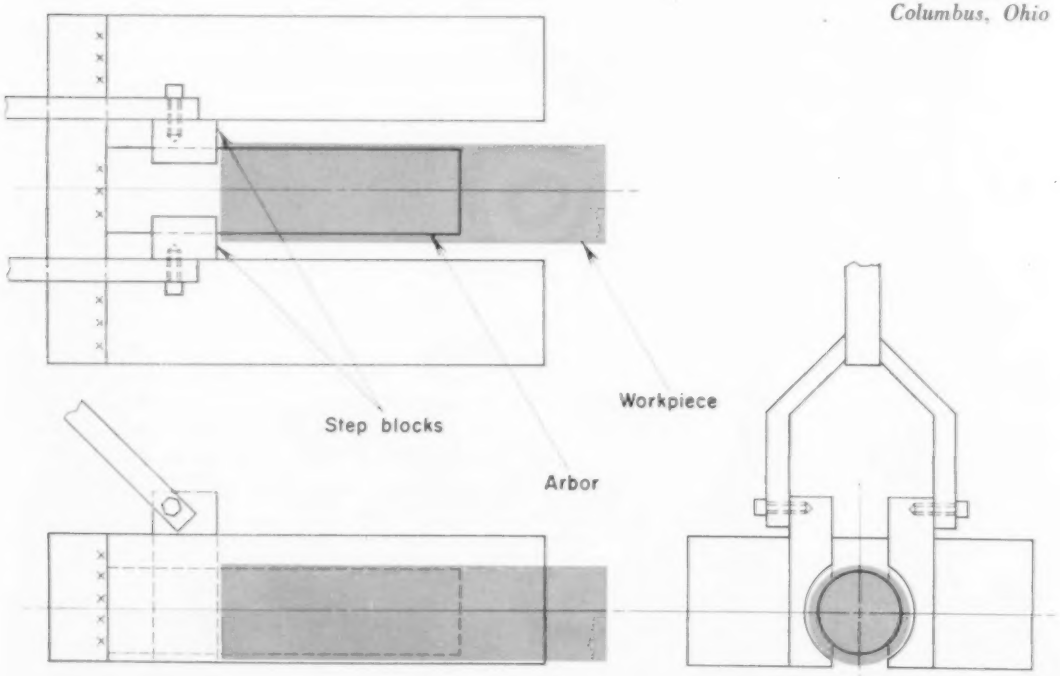
Band Saw Fixture

Slitting operations on tubular parts are performed quickly and accurately on the band saw fixture illustrated. The slit is one-half the length of the workpiece.

The fixture consists of a U-shaped frame, to which is welded a cylindrical arbor. The inside diameter of the workpiece is a sliding fit on the arbor.

Two sliding stop blocks fit between the arbor and the two long frame members. These blocks are fitted with a handle. To cut a slit, the operator positions a workpiece on the arbor, pushing it against the stop blocks. Steady pressure on the handle feeds the workpiece into the saw. Since the workpiece is firmly held on the arbor, vibration is held to a minimum and accurate slitting is assured.

Robert Hill
Columbus, Ohio



Gadgets

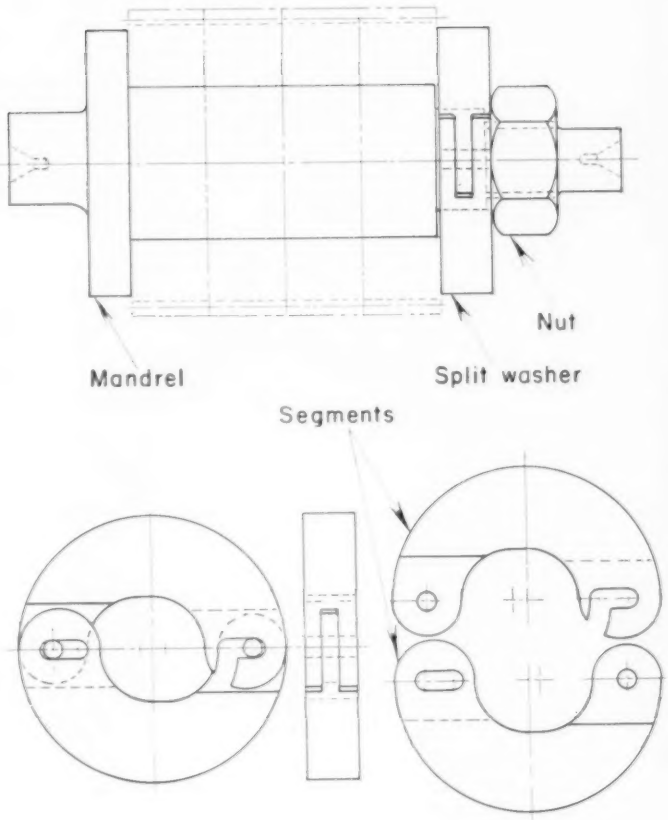
Split Washer for Hobbing

Spur gears are usually held on a mandrel for hobbing by a one-piece washer and nut. To remove the gears from the mandrel, the nut must be completely removed. By using a split washer as illustrated, loading and unloading are simplified.

The washer consists of two segments, held together by pins. These pins are a press fit in round holes in each segment. The pins pass through elongated holes, allowing the segments to move with respect to each other. One elongated hole is provided with a slot, allowing the washer to be opened when the segments are in the correct relative position.

A nut holds the washer and gears in position for hobbing. The OD of the nut is greater than the ID of the washer but smaller than the ID of the gears. When the hobbing operation is completed, the nut is loosened one-half turn, the two segments are unlocked and the washer is opened up and removed. Gears can then be quickly taken off the mandrel.

Stefan Gogol
Ashtabula County



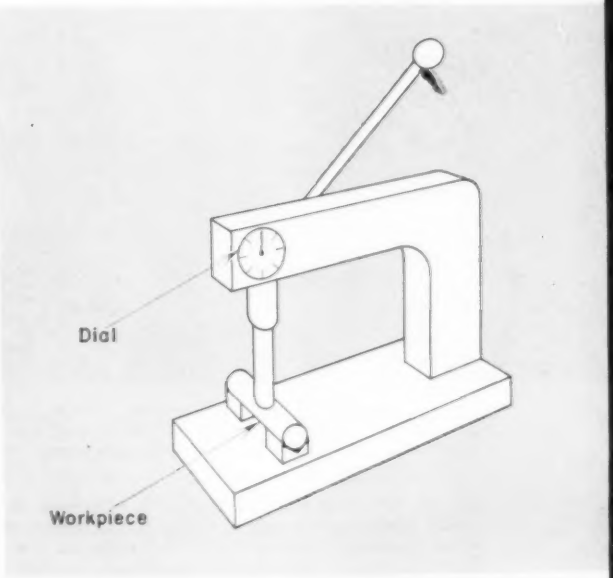
Indicating Dial for Arbor Press

To straighten shafts on hand arbor presses, a good deal of trial-and-error work is required. If a shaft is under-corrected after an initial straightening operation, there is a tendency to over-correct on the next operation. This difficulty can be minimized by mounting an indicator dial on the frame of the press. The pointer of the dial is attached to the end of the shaft which drives the press ram.

As pressure is applied for the first straightening operation, the indicator reading is noted. If the shaft is under-corrected after the first trial, slightly greater pressure, as shown by the indicator, is applied. In this way, over-correction can be avoided.

For rough straightening operations, the shaft can be rotated under the press ram and the dial used to check straightness. Shop experience has shown that the indicating dial is a handy attachment.

Ernest Jones
Bronx, New York



THREAD INSERTS
reduce cutter failures

OBTAINING ADEQUATE LIFE from the broach cutters shown in *Fig.* 1 was a problem because the area around the threads in the hardened (60-62 R_c) cutters pulled out as shown in the right-hand pair of cutters. When the threads "cratered" or a "plucking fracture" occurred, a pair of cutters worth $100 was thrown on the scrap heap. The failure might occur after one operation or at up to 50 percent of the normal life of the cutter.

Because of the unpredictability of failures of cutters without inserts, several cutters in all sizes were kept on hand so that production would not be interrupted for a longer time than that required to replace cutters.

The problem was solved at the Aluminum & Brass Corp. by installing Heli-Coil wire thread inserts. The holes are drilled and tapped for a class 3 fit. The teeth are cut and the cutter is heat-treated. Then the inserts are turned into threads to a depth of two threads below the surface. The threads provided by the inserts are $\frac{3}{8}$-16 x $\frac{9}{16}$ inch.

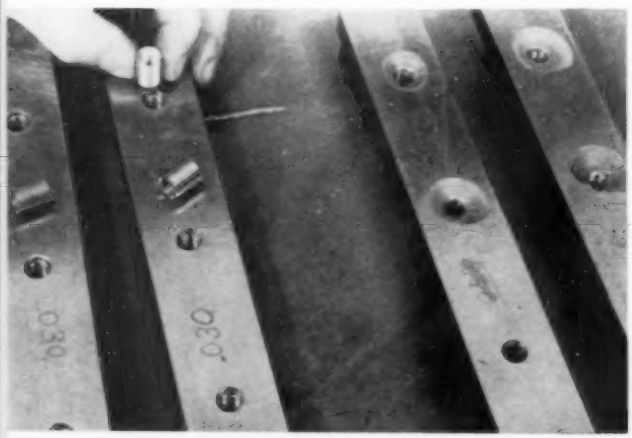


Fig. 1. Threads tapped in broaching cutters, right pair, caused the metal around the top to pull out as shown. Inserts, left pair, solved the problem.

Cutter life is now limited only by the thickness of the metal remaining after continued sharpening. When the cutters have been sharpened to the point where the grind wheel hits the bottom of the inserts, the cutter is scrapped.

Several reasons are advanced for the success of the inserts. Formed of stainless steel wire, they are flexible and distribute the screw load more evenly over all the threads in the parent material. By turning the inserts two threads below the surface, it is impossible for the top two threads to bear any load at all. The top surface is possibly more brittle than lower layers in the cutter. The cap screws which secure the cutter to the ram of the machine itself put stress on material below the surface. This material is less brittle and less likely to break out than the surface material.

Inserts are also used in the small clamping core holders which hold the bearing inserts in place while machining the split line. An insert is being turned into the threads drilled and tapped to receive it in *Fig.* 2. The resulting threads, ($\frac{1}{4}$ or $\frac{5}{16}$ inch) will receive the threads on the end of an arm which will hold it and the bearing cap in place while machining. These clamping cores cost approximately $20 each and are made of steel with a cyanide surface treatment. Before inserts were used, the cores would last two or three months. Now they last indefinitely.

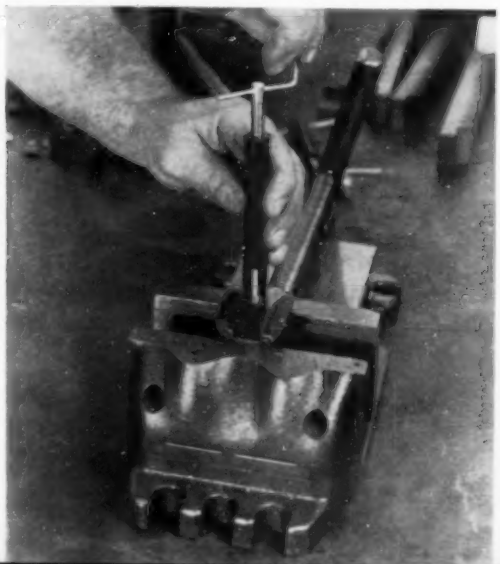


Fig. 2. Insert being installed in a clamping core which holds bearing caps in broach while cutters machine diameter. Thread failure was reducing life to 2 or 3 months. With inserts life is virtually unlimited.

making PRECISION MEASUREMENTS with optical tools

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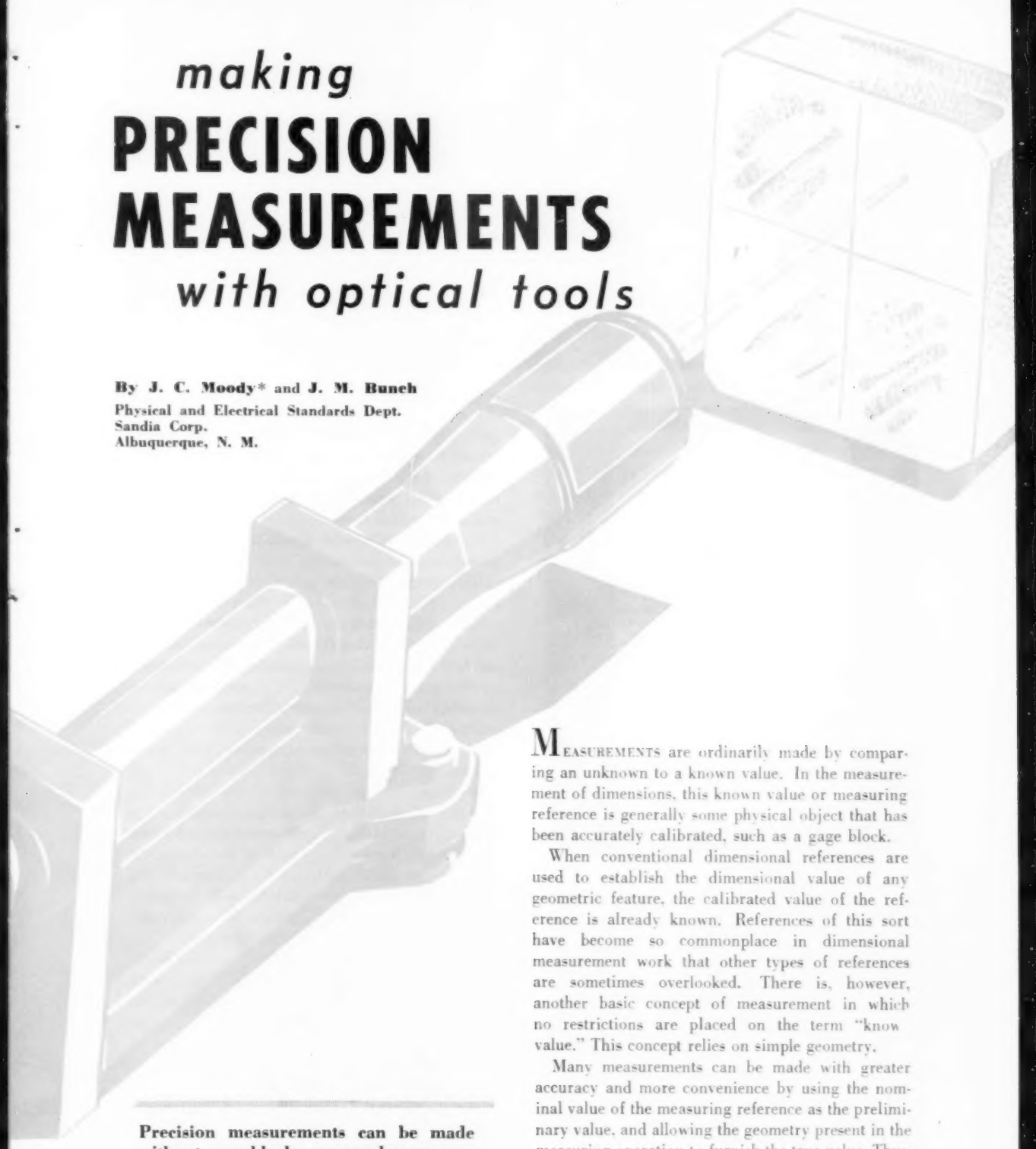

Precision measurements can be made without gage blocks or complex measuring equipment. The authors show how autocollimation and geometry can be applied in the shop as well as in the laboratory. Typical setups are described.

MEASUREMENTS are ordinarily made by comparing an unknown to a known value. In the measurement of dimensions, this known value or measuring reference is generally some physical object that has been accurately calibrated, such as a gage block.

When conventional dimensional references are used to establish the dimensional value of any geometric feature, the calibrated value of the reference is already known. References of this sort have become so commonplace in dimensional measurement work that other types of references are sometimes overlooked. There is, however, another basic concept of measurement in which no restrictions are placed on the term "know value." This concept relies on simple geometry.

Many measurements can be made with greater accuracy and more convenience by using the nominal value of the measuring reference as the preliminary value, and allowing the geometry present in the measuring operation to furnish the true value. Thus, a measuring procedure can be set up and followed which permits one to do two things: find the unknown value of the feature that is to be measured and, at the same time, obtain the unknown value of

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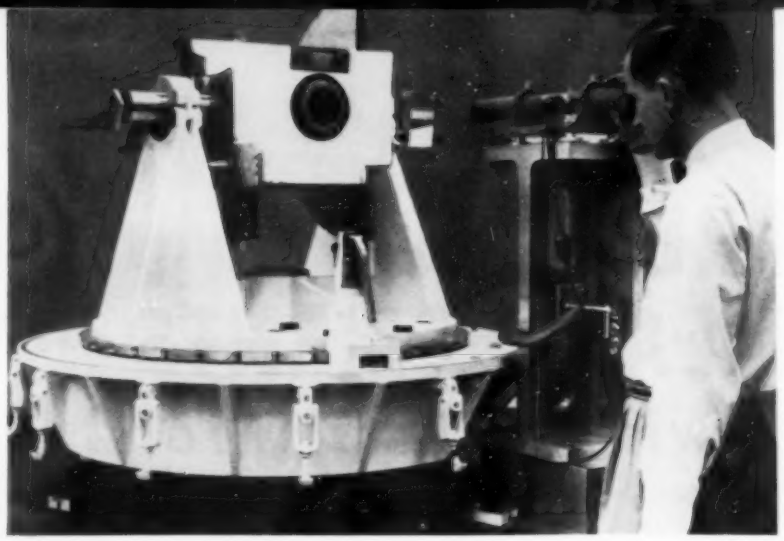
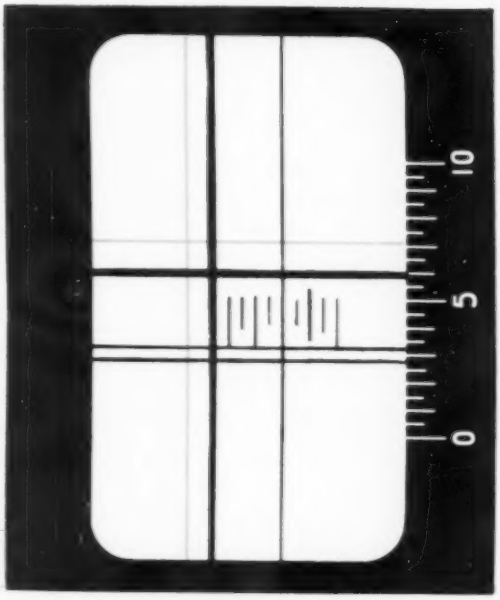


Fig. 1. (right) Calibrating the universal mounting of an aerial field camera with an autocollimator.

Fig. 2. (below) View through eyepiece of autocollimator. Image of reticle (color) is reflected from mirror. Angular deviation of mirror is read from appropriate scale.



the measuring reference. In most cases, both the procedure and the method of interpreting the data will be based on closing the circle, the principle of reversal, or both.

The accuracy obtained is usually equal to the precision of the instrument being used as the comparator. Where great accuracy is required, the comparator is usually a sensitive autocollimator, *Fig.* 1, or a precision indicator, preferably of the air-gage type. These instruments are characterized by absence of the lag or hysteresis usually present in most other types of indicating devices.

Principle of Autocollimator

Essentially, an autocollimator is an optical lens system from which light emerges as a parallel beam. The light passes through a reticle (cross-hair). When the beam of light is intercepted by a reflector such as a steel or glass optical flat, it is reflected back into the instrument, producing an image of the reticle at the focal plane of the lens system. Through a microscope, *Fig.* 2, the eye sees a scale, the reticle itself (the fiducial) and the reflected image of the reticle. Any change in the angular position of the mirror causes a change in the location of the shadow image. This change is accurately measured by means of the scale.

To be viewed through the microscope without parallax or fuzziness, the focal plane of the collimator lens must coincide with the plane of the reticle. An adjusting ring on the autocollimator permits this critical adjustment, which is made by the manufacturer. No further adjustment by the user is necessary.

Deviation from true flatness of the reflector has the same effect as the introduction of another lens into the optical system. In other words, such deviation changes the focal distance of the system. A convex condition in the mirror will lengthen this focal distance; a concave condition will shorten it. The effect of parallax or fuzziness from this cause will vary with the power of the microscope. The greater the magnification, the less the focal depth, and hence the greater the fuzziness. Thus, with autocollimators equipped with higher power microscopes, it is especially important that the various reflectors used all have the same uniform flatness of ¼ band or less per inch of mirror diameter.

Although the values supplied by the autocollimator are in angular measure, precise linear dimensions are easily obtained through conversion processes. This instrument is therefore quite versatile. Its versatility can be further increased by such accessories as the optical square, the twelve-sided optical polygon, and the Dowell prism. As the calibration of these accessories themselves offers several examples of the application of the principles

under discussion, an outline of how these instruments may be calibrated will serve to increase understanding of this type of measuring.

Checking an Optical Square

The optical square, which may be described as a pentagonal prism through which light is transmitted, provides a means of deflecting the parallel beam of light from the autocollimator at a 90-degree angle. The two internal reflecting faces of the prism are placed at 45 degrees to each other to accomplish this 90-degree deflection. When the optical square is used in conjunction with a suitably mounted reflector, the squareness of surfaces may be readily examined even when they are many feet apart. The optical properties of this prism make any critical orientation to the optical axis of the autocollimator unnecessary; the beam of light emerging from the exit face of the prism forms an angle of 90 degrees with the entrant beam regardless of the angle that the entrant beam makes with the entrance face of the prism.

A setup for determining the accuracy of this 90-degree deflection is shown in *Figs.* 3 and 4. The autocollimator is positioned so that its optical axis is reasonably normal to the external face of the prism that faces outward.

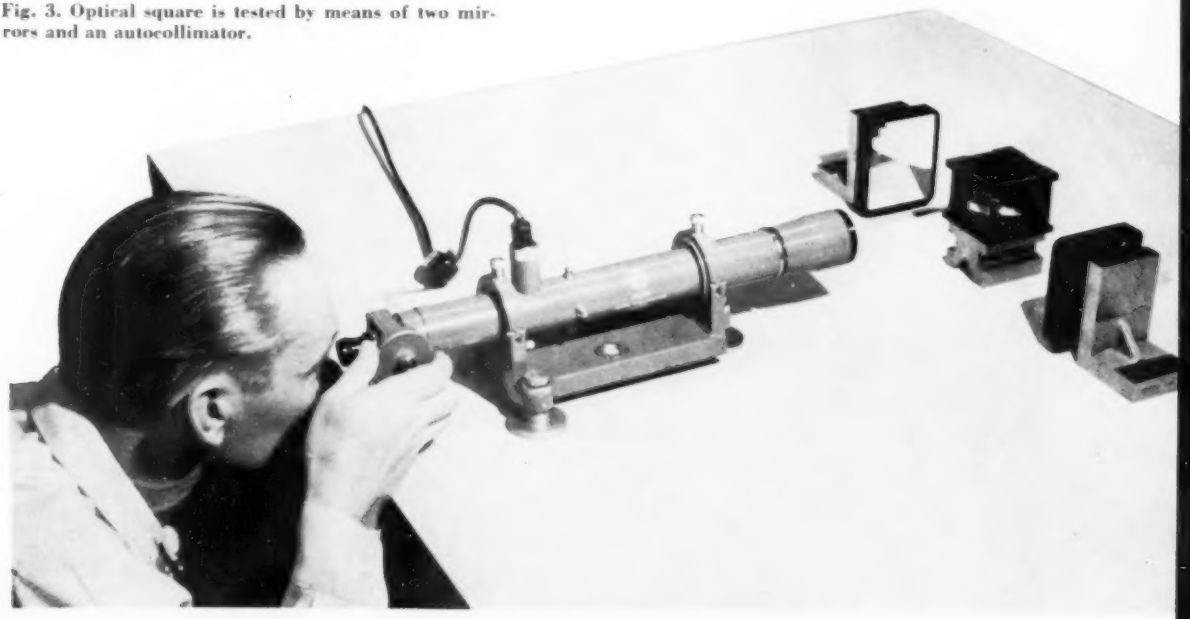
In checking, the first step is to take the reading of the image from reflector No. 1. Next, the prism is rotated clockwise nominally 90 degrees so that the face that was parallel to reflector No. 1 in position 1 is now normal to the autocollimator. Reflector No. 2 is gently tapped until the image being reflected from it appears on the scale conveniently close to the reading obtained from reflector No. 1. Reading No. 2 is now taken. For the third reading, the autocollimator is rotated approximately 180 degrees and the optical square 90 degrees in the same direction as the original rotation. The autocollimator is adjusted in this new position so that the image coming from reflector No. 2 appears reasonably close to the two previous readings. Reading No. 3 is taken. A final 90-degree rotation of the prism in the same direction permits the fourth and final reading, which is the position of the image from reflector No. 1.

The handling of signs in this operation and in others outlined in this article can be extremely complex. Considerable study is necessary to cope properly with this problem. The arrangement of equipment, the sequence of operations, and the reduction of data have been arbitrarily set up so that no trouble with signs will occur.

At this point in checking the optical square, the results consist of four readings, which, if treated in the following manner, will furnish the correction and final calibration value of the accessory being tested. Reading No. 4 is subtracted from reading No. 3; this difference may be called *A*. Reading No. 1 is subtracted from reading No. 2; this difference is called *B*. Now *B* is subtracted from *A*, and the difference divided by 4. The quotient is the amount and direction of the deviation from the nominal 90-degree deflection of the optical square. With an autocollimator of high sensitivity this deviation can be determined to an accuracy of ¼ second of arc.

In this test the autocollimator serves as a comparator, which is its basic function. If the optical square had a zero error the differences between the

Fig. 3. Optical square is tested by means of two mirrors and an autocollimator.



two sets of readings would be the same within the precision of the comparator, because the same angle is being measured and only the position of the autocollimator is changed. Therefore, the amount that these differences vary from equality is four times the error in the square, as the error in the square occurred four times in this measuring operation. The sum of these differences divided by two equals the amount the measuring reference deviates from the nominal—180 degrees. Division by two is required in this case because the 180-degree angle was measured twice. The true value of the measuring reference, which became known by implication as the measuring operation progressed, is now established. The basic measuring concept discussed—allowing the geometry present in the measuring operation to furnish the true value of the measuring reference—is thereby satisfied.

Testing a Twelve-Sided Optical Polygon

The twelve-sided optical polygon is used with the autocollimator to check circular division in 30-degree spacings. The exterior 30-degree angle between the adjacent faces can be calibrated to an accuracy of one second of arc. When so calibrated, it provides an excellent reference for the measurement of rotational displacements.

To perform this calibration, the polygon is mounted on a rotary table, *Figs.* 5 and 6. As the test is concerned with angular rather than linear displacements, centering the polygon is not a critical requirement. The autocollimator is positioned so that its beam is split between the first two faces of the polygon to be tested. The right half of the split beam is directed nominally perpendicular to face No. 1 of the polygon, so that the image is reflected from this first face. Reading No. 1 is now obtained. This reading becomes the reference for the entire test. A reflector is placed to the left of the autocollimator and gently tapped until the image reflected from face No. 2 of the polygon appears conveniently near reading No. 1. The purpose of this mirror is to reflect the beam of light that has been deflected by face No. 2 back to face No. 2, which in turn reflects it back into the optical system of the autocollimator. Reading No. 2 is now taken.

This reading is subtracted from the first reading, divided by two and recorded. The rotary table is rotated counterclockwise until face No. 2 of the polygon reaches the position relative to the autocollimator that was previously occupied by face No. 1. The table is then adjusted so that the image reflected from face No. 2 in this new position is reasonably close to the first reading. Reading No. 3 is taken. The image being reflected from face No. 3 will also appear, near where reading No. 2 previ-

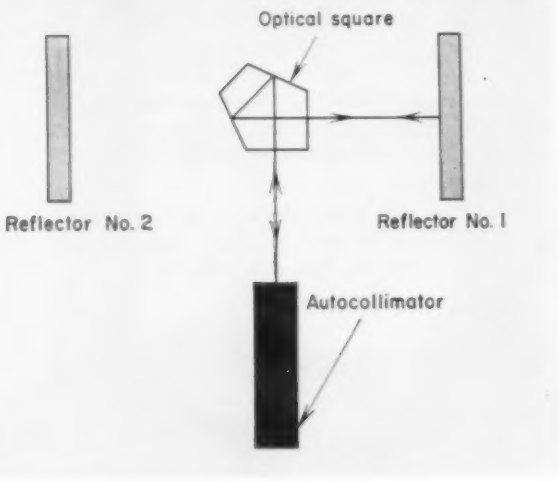
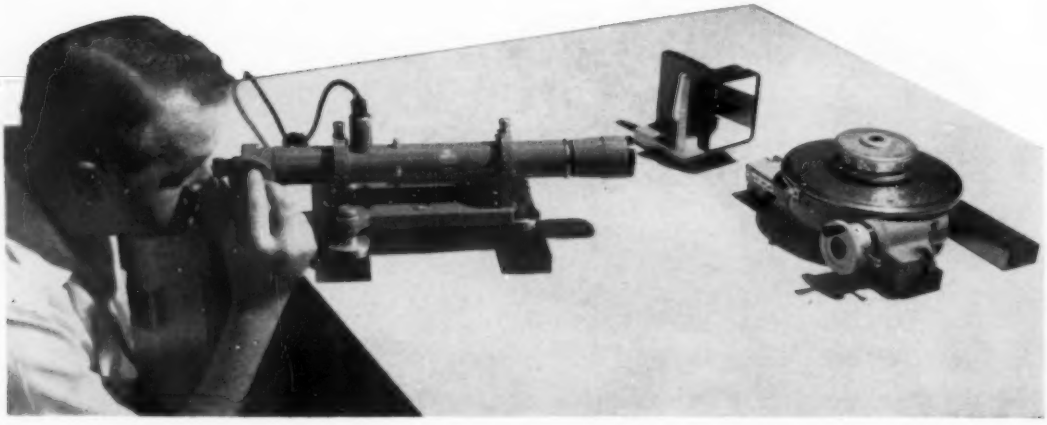


Fig. 4. (left) First position in the test of an optical square. Four readings are made.

Fig. 5. (below) Setup for the calibration of a 12-sided polygon.



Calibration of Twelve-Sided Optical Polygon with One Autocollimator

Angle (deg)	Recorded Differences (sec. of arc)	Deviation from Reference (sec. of arc)	Correction Factor (sec. of arc)	True Deviation from Nominal (sec. of arc)
0-30	8.0	0	—0.7	+0.7
30-60	7.1	—0.9	—0.7	—0.2
60-90	6.5	—1.5	—0.7	—0.8
90-120	6.3	—1.7	—0.7	—1.0
120-150	6.9	—1.1	—0.7	—0.4
150-180	8.4	+0.4	—0.7	+1.1
180-210	8.7	+0.7	—0.7	+1.4
210-240	8.4	+0.4	—0.7	+1.1
240-270	6.8	—1.2	—0.7	—0.5
270-300	6.4	—1.6	—0.7	—0.9
300-330	6.9	—1.1	—0.7	—0.4
330-360	7.2	—0.8	—0.7	—0.1
		—8.4		0

Note: Correction factor is —0.7 (—8.4/12)

ously occurred. This is recorded as reading No. 4. Reading No. 4 is subtracted from reading No. 3 and this difference is termed *A*. Reading No. 3 is subtracted from reading No. 1 (reference) and this difference is termed *B*. After subtracting *B* from *A*, the difference is divided by 2 and recorded. The differences are divided by two in this test because their actual values have been doubled by use of the stationary mirror.

By repeating the operation, all twelve exterior angles of the polygon are measured. In each of the subsequent operations, the value of term *B* is likewise obtained by subtracting the first reading in each operation from the reference reading.

The exact error from the nominal 30-degree value of the measuring reference—the exterior angle between faces No. 1 and No. 2 of the polygon—is included in each of the twelve measurements. This error, therefore, may be found by dividing by 12 the algebraic sum of the amounts that each angle deviates from the value as established by the measuring reference. Each of the twelve values is then corrected by algebraically subtracting this amount, as shown in the accompanying table. As the sum of the exterior angles must be 360 degrees, the algebraic sum of the final values must equal zero.

The method used in this procedure and in others outlined in this article is termed the differential method of measurement. Its chief merit is that it makes accurate settings during measuring procedures unnecessary. In other words, it takes advantage of the universally accepted principle that it is easier to read a value than it is to set an instrument to a given value.

Testing a Dowell Prism

Checking the parallelism and squareness to the axis of spindle rotation of the measuring faces of

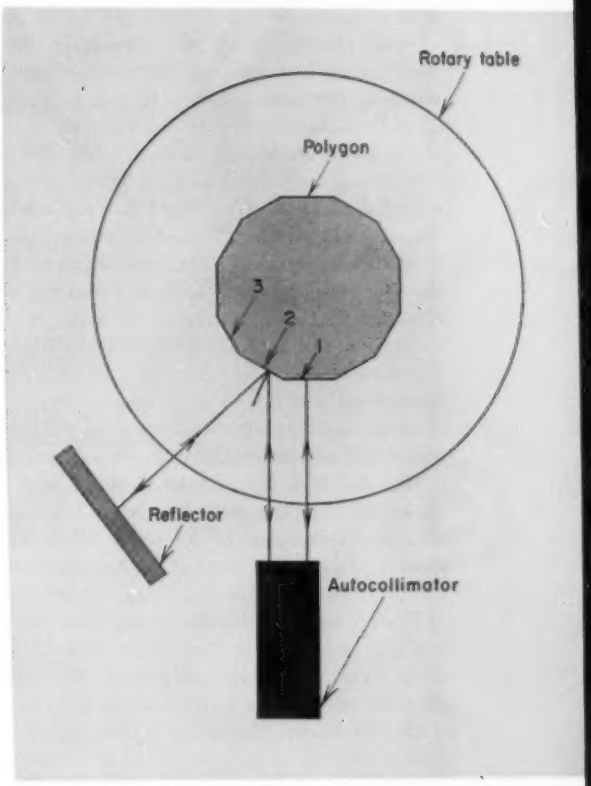


Fig. 6. First position in the test of a 12-sided polygon. Accuracy is within one second of arc. Calibrated polygon is used to measure rotational displacements with auto collimator.

outside micrometer calipers is accomplished with a Dowell prism. This prism consists of two primary parts: a conventional roof prism and an upright reflecting surface normal to both surfaces of the roof. It possesses the optical property of deflecting a beam of parallel light rays that has been split about the apex of the roof into space in opposite directions, regardless of the angle that the incident beam from the autocollimator makes with the reflecting surfaces of the prism. As with the optical square, the inherent optical properties of the prism make unnecessary any critical orientation of the incident beam from the autocollimator with the prism. Orientation is governed only by the range of the autocollimator.

Because mutual perpendicularity of the three reflecting surfaces cannot be exactly achieved, the light rays deflected by a Dowell prism will deviate slightly from a common axis. The magnitude of this deviation can be determined to an accuracy of $\frac{1}{4}$ second of arc by the following method.

Checking is based on the principles of reversal and differential measurements and is much the same as that outlined for the testing of the optical square. To completely analyze the Dowell prism, however,

it is necessary to test in both the horizontal and vertical planes; hence, the measuring reference must supply both values. This is made possible by wringing precision parallels to two opposed faces of a Tru-square, allowing the parallels to project about two inches beyond the body of the Tru-square. For testing, the Dowell prism is placed between the extended parallels, *Figs.* 7 and 8. Proper height of the assembly may be obtained by any suitable platform such as parallels. The autocollimator is positioned so that the beam of light strikes the upright reflecting surface at a convenient angle, say about 45 degrees, and is evenly split about the prism roof. The autocollimator is turned so that its scale is in the vertical position. This turning is necessary because the optical path of the rays from the autocollimator that are deflected by the Dowell prism to a mirror and back through the system is such that a horizontal displacement of a test mirror causes a vertical displacement of the image in the autocollimator. Likewise, a vertical displacement of a test mirror causes a horizontal image displacement.

The Tru-square is rotated in the horizontal plane and adjusted in the vertical plane until the images from either reflecting surface of the reference parallels appear in a convenient place in the autocollimator scale. The setup is now complete for determining the magnitude of the error that exists in the horizontal plane. The readings of the images from reflecting parallel No. 1 and parallel No. 2 are now taken. The Tru-square is rotated a nominal 180 degrees, and adjusted by rotation until the images again appear reasonably close to the location of the original images. Reading No. 3 is taken. This is the image from parallel No. 2 after the 180-degree reversal of the Tru-Square. Reading No. 4 is the image from parallel No. 1. Reading No. 4 is subtracted from reading No. 3; reading No. 1 is subtracted from reading No. 2. These differences are termed *A* and *B*, respectively. The value *B* is subtracted from *A* and divided by 2. The quotient is the amount and direction of the deviation from a common axis in the horizontal plane. This difference is divided by 2 in this case because the error was included in the measuring operation twice. Again, because of the principle of reversal, the true deviation from the nominal 180-degree value of the reference is the sum of the two sets of readings divided by 2.

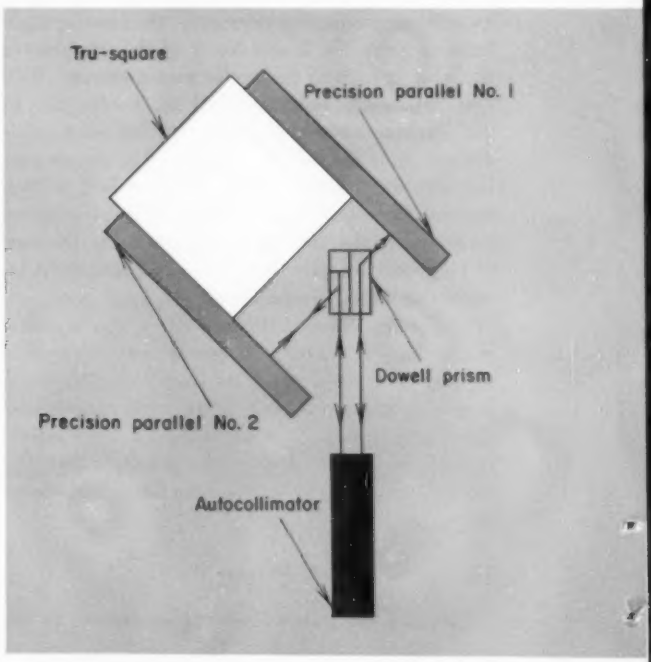
To obtain the error in the vertical plane the autocollimator is rotated about its axis 90 degrees and the same procedure repeated. In the vertical test, the reversal of the measuring reference is obtained by the 180-degree inversion of th Tru-square assembly instead of the 180-degree horizontal rotation required in the horizontal test.

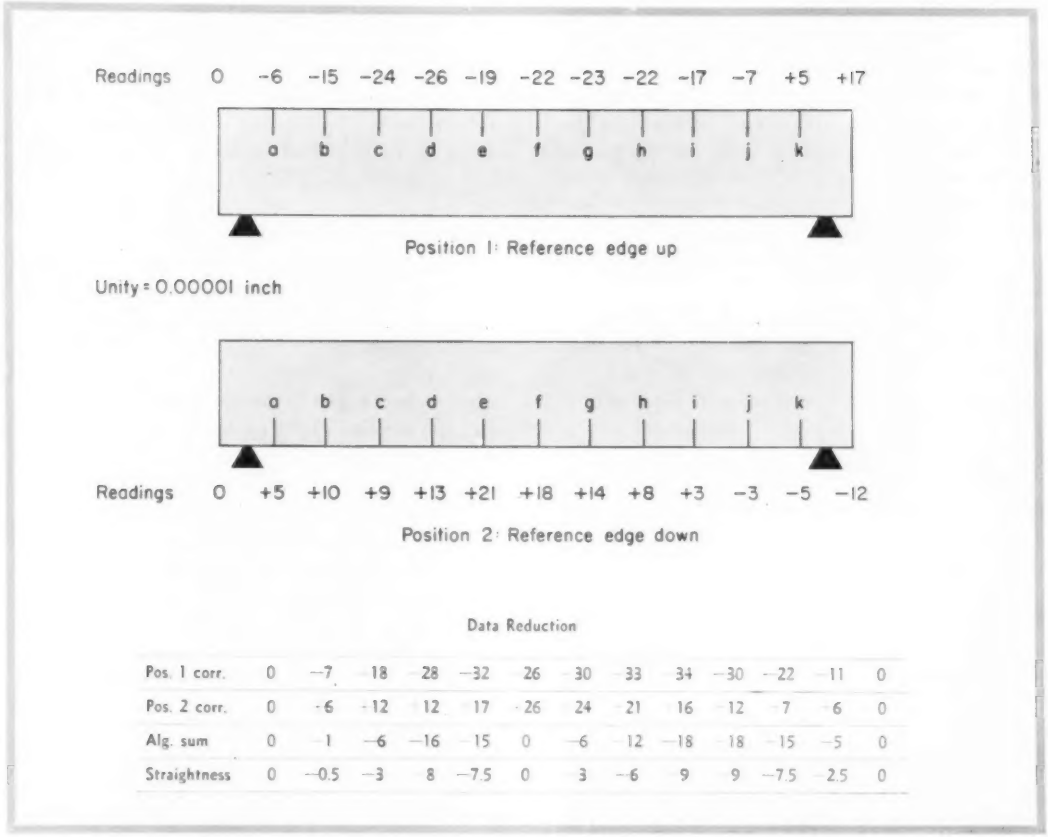
Fig. 7. (above) Setup for testing a Dowell prism. Prism is placed between two parallels.

Fig. 8 (right) First position in the test of a Dowell prism. Tru-square spaces parallels.

Checking a Straightedge

Flatness of the surface from which measurements are made is not a factor in the reversal method of testing the straightness of beams. The surface must





Data Reduction

Pos. 1 corr.	0	−7	−18	−28	−32	−26	−30	−33	−34	−30	−22	−11	0
Pos. 2 corr.	0	−6	−12	−12	−17	−26	−24	−21	−16	−12	−7	−6	0
Alg. sum	0	−1	−6	−16	−15	0	−6	−12	−18	−18	−15	−5	0
Straightness	0	−0.5	−3	−8	−7.5	0	−3	−6	−9	−9	−7.5	−2.5	0

Fig. 9. In testing straightedge, readings are taken with reference edge up, then with reference edge down. Data is then reduced to determine actual straightness.

be rigid and smooth enough, however, to permit reading from any area to be repeated as many times as required for the test.

A beam is deflected by its own weight when resting on two support points in the horizontal plane. If the beam is of uniform and symmetrical cross-section, this deflection will be duplicated when the beam is rotated 180 degrees on its longitudinal axis and supported on the same points. It can be seen that if the beam is a round shaft rotated in a lathe, an indicator at any point on the shaft will indicate twice the out-of-straightness at that point, assuming that the shaft is running true at its support points. Deflection in this case is not a consideration and does not need to be known. An indicator traversed along the top of the shaft at rest would show a composite of deflection and straightness of the shaft, and the errors in the machine ways, as well as difference in height of the supports above the ways. These unknown effects on the readings are cancelled out in the method to be outlined.

The test piece used in this method is a steel straightedge. It is supported at its end by suitable blocking on a surface plate with the edge to be tested at the top. The ends are adjusted in height to approximately the same readings on an air-test indicator, this instrument having comparatively light measuring pressure and being easily read to 0.00001 inch. Beginning at the left end, *Fig.* 9, readings are taken at desired intervals along the length and recorded. They are given a plus or minus sign as referred to the left end reading as zero. Next the straightedge is inverted and readings taken at the same points as in the face-up position, care being taken to return the indicator base to the same positions as for the first set of readings. These are also plus or minus as referred to the left end, the downward direction now being plus, because the indicator is also inverted. The two lines of readings are now corrected by arithmetical progression to bring the right hand ends to zero, since the line joining the two ends will be the reference for straightness.

Now as the deflection of the edge measured is the same in both positions, it is obvious that the readings on a true straightedge would be the same, although of opposite sign, for each point in both positions. Also, for each point the algebraic sum divided by two will be the error in straightness at that point, a plus sign of the quotient indicating a

high point. The division by two is necessary because the error was measured twice.

Errors in the flatness of the surface plate do not affect the final results. For instance, if the surface plate were higher by 0.0001 inch at station *e*, the top reading would change to —36, but the bottom reading would change to +36, so that there would be no change in the calculated error in straightness, which is zero for this station. Therefore, the reversal alone determines the reference line and deviations from it.

Other accurate but tedious methods have shown that in the two positions, the difference in deflection of the materials requiring such tests is negligible. Furthermore, the supports may be at the points of least deflection or wherever convenient, as the results of the test will always be the same. The determination of straightness by this method is accurate to 0.000025 inch, assuming the reference edge being tested has a surface roughness of 4 micro-inches, AA, or less.

In case the straightedge has two reference edges, the second edge is also measured while in the two positions, and the parallelism of the edges is determined without further measurement. It is apparent that the algebraic sum of the readings on opposite edges at any station, referred to the left as zero and before correction to the right, is the deviation from parallelism.

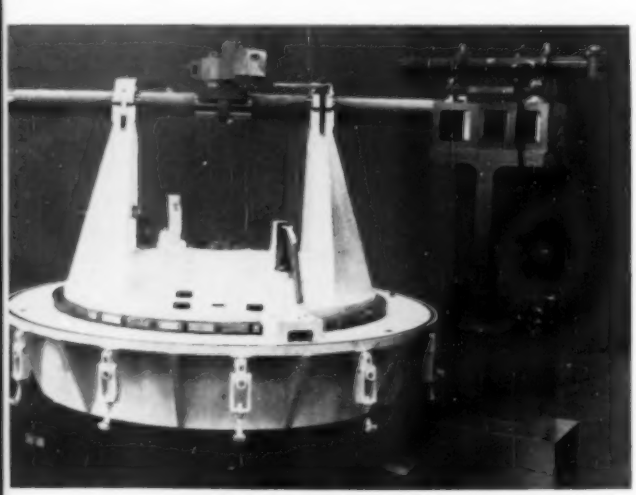


Fig. 10. A 10-degree prism and an autocollimator are used in calibrating the 10-degree index stations of an aerial plotting camera.

Practical Application

The preceding examples serve a two-fold purpose: they illustrate specific application of the principles under discussion, and they indicate to some degree the usefulness and scope of this method of measurement in gage laboratory work. Use of these principles, however, is by no means restricted to gage laboratories. They afford the shop a fast and economical means of obtaining accurate measurements. Fabrication and inspection of precision parts, produced in small lots, are perhaps their most valuable field of application, although as the method becomes better known, other fields of application will no doubt be explored.

A typical application is calibrating the universal mounting of a field camera used in aerial plottings, *Figs.* 1 and 10. The elements to be determined are the parallelism of the leveling pads with the horizontal plane of rotation; the parallelism of the trunnion bearings with the horizontal plane of rotation; the position of the 10-degree index stations of the azimuth circle; and the position of the 10-degree index stations of the vertical circle. Desired accuracy of the calibration is two seconds of arc. Deviation from the true plane of rotation by the features tested, the surfaces of the pads and the axis of the trunnion bearings, will obviously introduce an error in the results. This error does not exceed 0.5 second of arc in the setup illustrated.

The parallelism of a plane contacting the surfaces of the leveling pads with the plane of rotation of the mount is determined by the principle of reversal. As shown in *Fig.* 10, the pads are in a triangular group in the base of the rotating member. Legs of the triangle are respectively parallel and perpendicular to the axis of the trunnion bearings and are about 6½ inches in length.

Finding the comparative height of the pads of the parallel leg above the plane of rotation presents no problem. They are brought under a sensitive indicator by rotating the mount; the angular value may then be computed. Finding the height of the inner pad on the other leg presents some difficulty, considering the accuracy desired. Two seconds of arc, at a radius of 6½ inches, allows a linear measuring error of only 0.00006 inch.

Moving the indicator from pad to pad would introduce the errors in flatness of the surface of the surface plate and would require precise parallelism of this reference surface with a rotational plane of the mount, which is not easily achieved. None of the various methods presented here involves such a reference, because the surface plate is only a convenient support for the work and the measuring instruments. The reversal method used in this instance is shown in *Fig.* 11.

A reflector of sufficient height to be viewed across the central web of the mount is placed on a parallel bar bridging the pads with the mount in position 1. The autocollimator reading is recorded, and the mount rotated 180 degrees to position 2. The reflector and parallel bar as a unit is reversed on the pads, care being taken that the pads contact the same areas of the parallel bar. A second reading is

taken, the autocollimator remaining undisturbed between readings.

The two readings will be identical only if the tops of the pads are exactly parallel to the plane of rotation. As inspection of *Fig.* 11 will show, any difference in the two readings will be twice the angular deviation from parallelism. It can be seen that the actual angle is doubled by the reversal of the positions of the pads as seen by the autocollimator.

Because the measuring reference has been established as the mean of the two readings, the perpendicularity of the reflector to the plane of its feet does not affect the results of this test. In the autocollimator used, a tilt of the reflector toward the instrument causes a higher reading on the scale, and vice versa. Therefore, a lower reading in position 2 indicates that the inner pad is higher than the outer pad in relation to the plane of rotation. The accuracy obtainable in this test depends to a great extent on the flatness of the parallel bridging the pads. Considering the flatness of the parallel used in this case, the desired accuracy of two seconds of arc was met.

The trunnion bearings, like the two pads that are parallel to the horizontal axis, are tested with an indicator. A cylinder of the required diameter is placed successively in each bearing and the mount is rotated so that the indicator contacts the cylinder.

Determining the positions of the nominal 10-degree index stations in both the azimuth and the vertical circles is based on the closing of the circle and is another form of the method used in calibrating the twelve-sided polygon. The measuring reference in this case is a prism with two reflecting faces forming a nominal 10-degree exterior angle, and the comparator is the autocollimator. Provision is made for adjusting and clamping the prism mounting bracket as the circle is traversed.

With the camera mount indexed at zero azimuth, one face of the prism is oriented to the autocollimator and a reading taken. The mount is then indexed at 10 degrees azimuth, bringing the second face of the prism into the field of the instrument, and a second reading is taken and recorded with the first, as a pair. This completes the observation for the 0-10 degree index spacing. The first face of the prism is now again oriented to the autocollimator, and the 10-20 degree readings taken; this procedure is repeated for every spacing, ending with 350-360 degrees. The differences of the readings in each pair are added algebraically, the average of these 36 differences being the deviation of the prism angle from 10 degrees. Since the true angular value of the measuring reference is now known, the spacing of each index station from the zero station is readily calculated. In this case the principle of kinematic positioning followed in the indexing permits the circle to be precisely closed, with an accuracy probably within one second of arc.

To calibrate the vertical circle the foregoing procedure is carried out with the 10-degree prism, but as the indexing is to 180 degrees only, the position of this last station is verified by the calibrated twelve-sided polygon which is attached to the end of the trunnion. Using two opposite faces of the polygon, the deviation of the last station from 180 degrees is found, and applied as a correction to the sum of the differences of all 18 stations. Division of this corrected sum by 18 gives the deviation of the prism angle, and the positions of the stations are calculated as before. Because the method of holding the prism in its bracket introduces a possible change of one or two tenths of a second resulting from distortion in the two mountings, the prism angle is determined for each circle. This is important when striving for the greatest accuracy.

Testing the vertical circle is a good example of the value of the calibrated polygon in uses outside the laboratory. In this case, however, the 10-degree prism is referred to a physical reference, the optical polygon. The calibrated value of the polygon may be in error as much as one second; therefore, the accuracy of the values found for the vertical is not as great as for the azimuth where the circle was precisely closed.

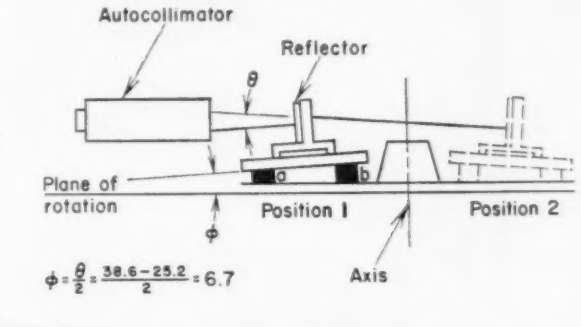


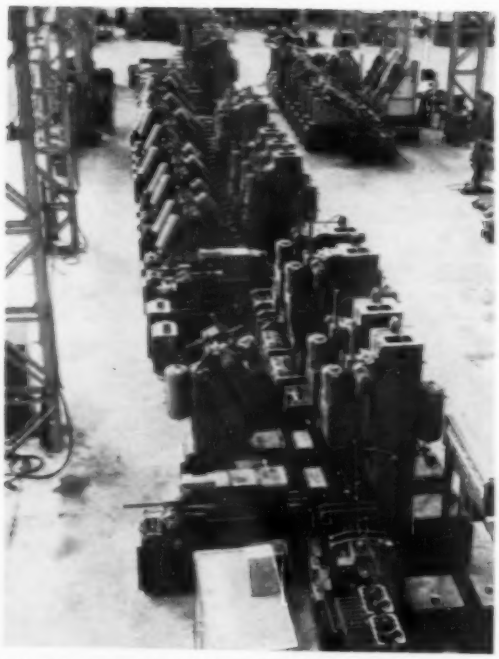
Fig. 11. Setup for testing parallelism of pads. Autocollimator reading at position 1 was 38.6 sec., at position 2 it was 25.2 sec. Deviation from parallelism is therefore 6.7 sec.

These examples indicate the wide application and the convenience of a method using the principles of reversal and of closing the circle. Used with the differential method of measurement, the principles described eliminate the need for precise calibration and adjustment of measuring equipment and free the measuring process from the limitations of conventional "known value" standards. Autocollimation and geometry can therefore be a flexible and valuable tool both in the laboratory and in the shop.

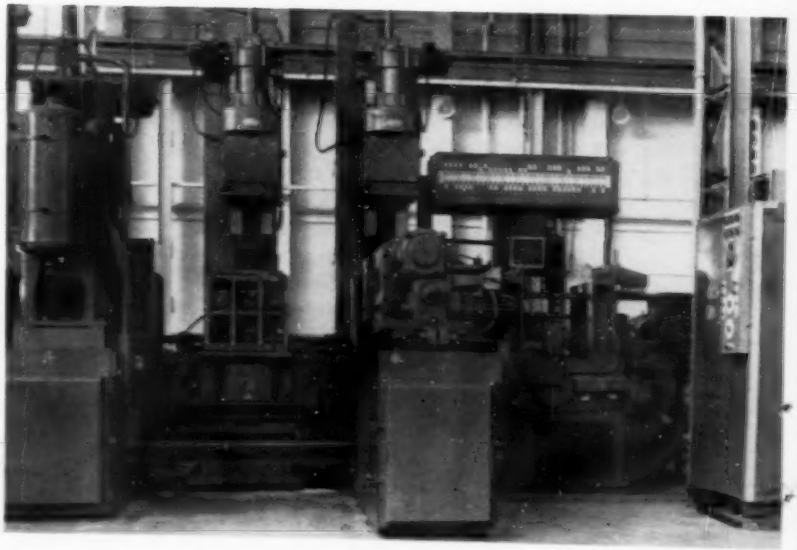
designed for
PRODUCTION

Standardized Units Simplify Designs

Building-block system for constructing machines from standard parts facilitates design and speeds construction of special machines at the Birmingham, England plant of the Austin Motor Co. Ltd. Standard components are carried in stock and become the basic elements of any production machine that will be required. These building-block features include unit heads, branch beds, vertical columns, angular columns and pneumatic and electrical components. This conserves considerable design time and drafting effort. Also, as soon as designs are released for manufacturing, the major components can be drawn from stock. In this way, building a special machine becomes largely assembly and fitting operations.



TRANSFER MACHINE with 35 stations for machining cylinder blocks. This is a nonplaten type machine, the workpiece being clamped upward into fixed-bridge type fixtures at each station. The stations perform drilling, milling, tapping, reaming and trepanning operations. Feeler stations are included for the tapping positions. Cylinder blocks are not honed but are fine bored and burnished with spring-loaded rollers. Mist coolant is used for the tapping stations. Pneumatic counterweights are employed for balancing the heads. Tanks seen on the column are accumulators for this purpose.



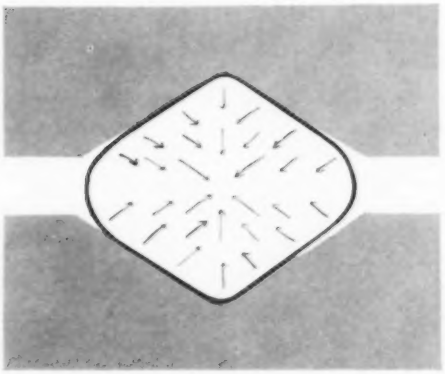
FIRST STATION of transfer machine. Indicator board signals the position of the tools and the clamping or unclamping of the component at each station. The panel below the indicator board shows whether all the tools have fed into the correct depth.

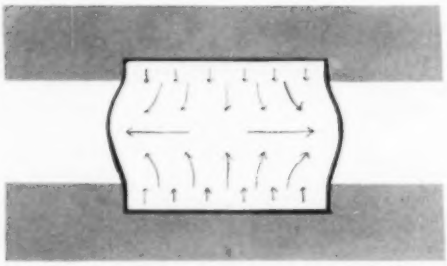
Cutting Tools Change Automatically

Using a punched-card control, the cutting tools are changed in this Fosdick jig boring machine according to a preset program. With the controls developed by the International Business Machines Corp., choice of thirty or more tools, positioning of holes, spindle speeds and feeds, hole depth and spindle head height are all programmed by IBM cards. In use for the production of side frames for data processing equipment, operations are performed on 16 by 18-inch frames with total hole location error within 0.0004 inch. Shorter setup time effects inventory savings through smaller lots.

Measurement of table position along the X and Y coordinates is achieved by lining up a series of end measuring gages. The gages are selected by motor-driven drum dials and positioned end-to-end to provide the required measurements indicated by the punched card. Movement of the table stacks the gages and moves them against a limit switch. At this point the table is stopped, the leadscrew is relieved by reversing slightly and the table is clamped within an accuracy of ± 0.0004 inch.

AUTOMATIC TOOL CHANGER selects the programmed tool from the rack and inserts it into the spindle. The changer is faster than manual operation and can be operated simultaneously with all the other machine functions. The storage unit is floor mounted separate from the machine. Tools are carried in a disk which is indexed by the card control. The unit slides on horizontal tie rods so that tools may be positioned under the spindle. Spindle downfeed is controlled by pulses for each 0.001 inch of feed.

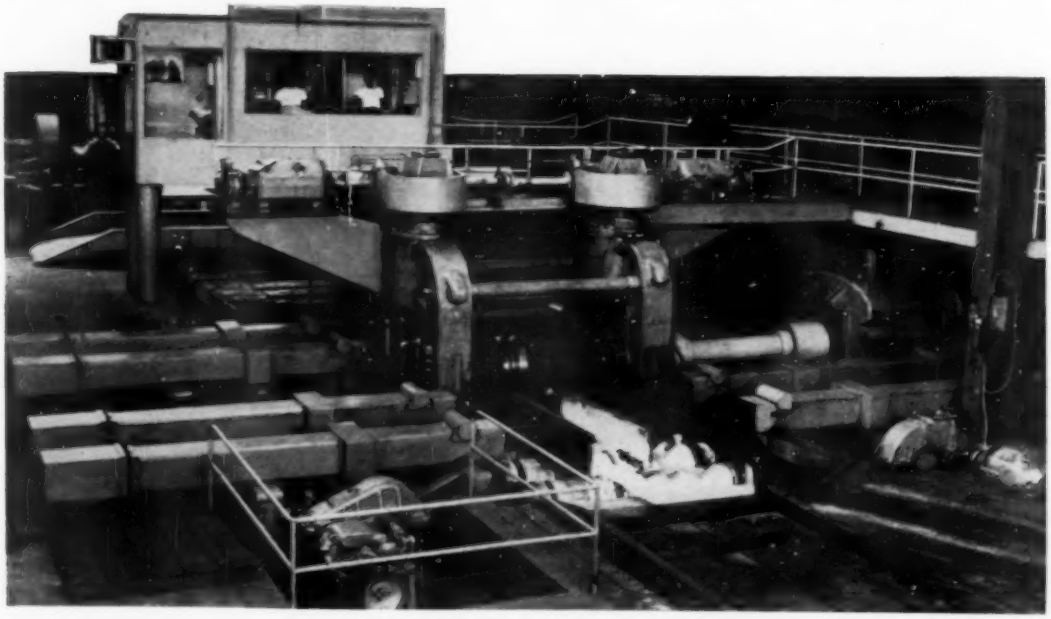




Rolling Mill Supplants Forging

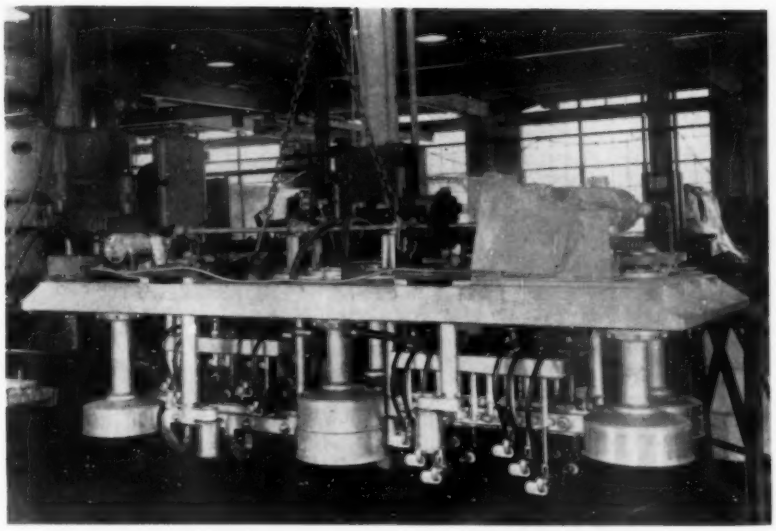
Replacing the time-honored forges for hot-working stock of exceedingly hard steels, a 32-inch cogging mill, developed by Latrobe Steel Co., is capable of producing the dense, well-worked internal structure required to develop the full properties of these alloys. Formerly, it was thought that only the forging press could perform this work. Development, however, of special diamond-shape rolls provides the internal hot-working necessary. The rolling mill works the ingots to shape faster, quicker and more uniformly than was possible in the forge. The mill handles ingots as large as 18 inches square, producing stock from 3-inch square billets to 12-inch wide slabs.

DIAMOND-SHAPE ROLLS, top, are one of the key developments for satisfactory rolling of superalloy and high-speed steels. Arrows indicate the direction of pressure. Diamond groove rolling tends to distribute the hot deformation uniformly to the center of the ingot, producing the kneading action required to compact and refine the internal structure of the steel. Conventional box or flat rolls are shown below the diamond-shape rolls. Arrows indicate the nonuniformity of rolling and the tendency to rupture the center because of unrestricted lateral flow.



COGGING MILL uses diamond-shape rolls to hot-work hard steels. Control pulpit is at the rear. Extending outward at the lower left are manipulators which slide back and forth in conjunction with similar manipulators facing them, and aim ingots at the correct rolls.

Abrasive Jet Provides Smooth Finish



INTERNAL MECHANISM of liquid-abrasive machine. Two interlocking sets of rubber belts handle the parts to be finished. The first set grasps the workpiece between belts in such a way as to expose most of the surface to the abrasive spray from the oscillating guns. The second set of belts carries the work through another spray area.

Microscopically smooth finish is imparted to aircraft, missile and automotive components in the finishing machine designed by Lewis Welding and Engineering Corp. Work handling between rubber belts and spraying from an oscillating nozzle make the machine cycle automatic. Control of mixture of air in the jet with the slurry determine the finish obtained. Ratio of water to abrasive as well as abrasive-particle size also affect the finish which may be controlled as desired. After the abrasive treatment, the parts pass through a rinsing compartment where the abrasive is completely washed off. Finishes are satisfactorily obtained on aluminum, copper, mild steel, stainless steel and titanium.

Squirrel-Cage Workholder for Hardening

Tooled for simultaneous hardening of both ends of steel rods, this induction hardener automatically heat treats and quenches one rod each second. An extremely simple feeder, the operation requires little attention or maintenance. Designed by Cincinnati Milling Machine Co., the induction heater utilizes 1000 kilocycles so that depth of case is shallow, scale does not form and distortion is held to a minimum.

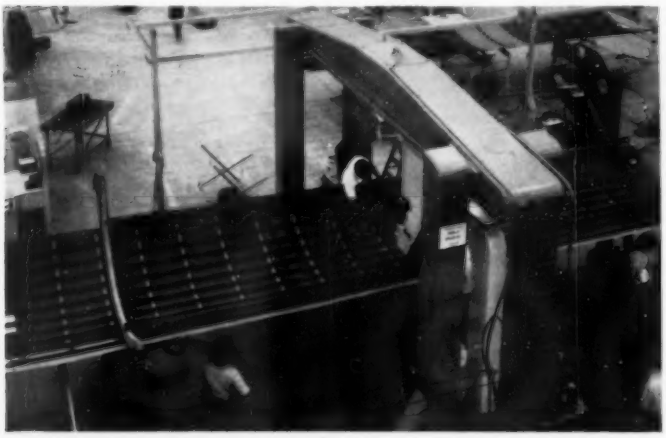
PARTS ARE LOADED into magazine tray which automatically feeds them into notches in periphery of a rotating drum fixture. As parts are carried around the drum, each end is passed through an arc-shaped high-frequency heating coil. Parts drop by gravity into a quench tank below. A conveyor in the tank delivers the hardened parts at the right side of the machine.

Gantry Riveter Eliminates Movement of Work

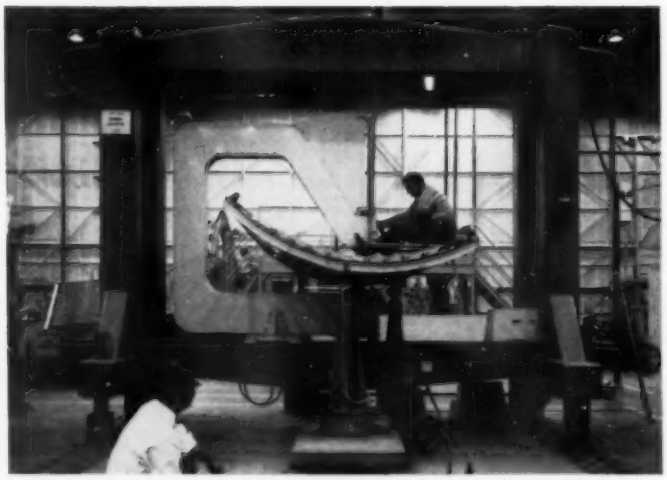
Designed to assure quicker and more efficient riveting to the close tolerances required for DC-8 Jetliners, a gantry machine brings the riveting operation to the work rather than moving the work to a stationary riveting location. This method of riveting also eliminates the intricately tooled workholder used under stationary riveting machines. Deflection of the riveting yoke is greatly reduced because both its top and bottom bear against the gantry frame. In addition, less floor space is required. Because the panel does not move through the machine, panel clearance to right and left of riveting head is not required.

Riveting head is easily positioned by hand over the rivet location. An automatic cycle starts with the bottom cyclinder. This exerts a clamp force to squeeze the panel against the head of the rivet. Rising with the lower cylinder, a rivet gun upsets the rivet against an anvil and retracts. The shaving head then trims the rivet. The machine allows scatter patterns to be riveted without intricate programming. It also allows for quick engineering changes.

This system of riveting was conceived by T. S. Crispin, Tooling Administrator of the Santa Monica division of Douglas Aircraft Co. The machine is manufactured by Manco Mfg. Co.



FUSELAGE PANELS being riveted. While panel is held on simple sensing fixture the gantry moves around it for its full length, riveting the panel and shaving the excess rivet material.



CLOSE-UP OF GANTRY riveter in operation. Panel is supported on 3-point unit that keeps curved panel 90 deg to riveting mechanism at point of operation.

Building-Block GAGES cut jig fabrication costs

By **Joseph Less**
and
Leo Willick
Taber Instrument Corp.
North Tonawanda, N. Y.

Building-block gages can be made quickly in the shop from standard components. They are especially suitable for measuring long dimensions. The equipment and a typical application are described by the authors.

DURING THE PAST FEW YEARS, both the size and speed of aircraft have increased. Fixtures for the assembly of these aircraft must be larger and, at the same time, more accurate. The cross-sectional form of a tail section, for instance, must meet dimensional tolerances previously thought to be unattainable in large aircraft assemblies. Construction of typical tail sections takes place on fixtures forty or more feet in length. These fixtures incorporate reference points that serve to locate tail parts and auxiliary structures. To maintain accuracy, the location of reference points is periodically checked with a jig as long as the fixture itself.

Since the accuracy of the fixture is dependent on that of the checking jig, reference points on the jig must be precisely located. At Taber Instrument Corp., jig construction has been facilitated by use of "building-block" gages, capable of making measurements up to seven feet in length with gage-block accuracy. Such gages are used to locate all reference points on the jig.

Jig Construction: A jig for checking tail section assembly fixtures, *Fig.* 1, is 40 feet long and weighs 6000 pounds. The body of the jig is a tube. Two channels are welded to the tube and their exposed surfaces are machined to provide smooth reference surfaces. "Targets"—reference points for checking the assembly fixture—are located at intervals along the top and sides of the jig.

The targets on the top of the jig are round steel disks fastened to the surface of the upper channel. Spacing intervals of the top targets correspond to "zones," imaginary cross-sectional planes through the airframe.

Side targets, which consist of metal blocks, must be located in a known relationship to the zones. Dowel pins inserted in lapped holes in the blocks serve as locating surfaces for future checking and inspection operations. The average distance between the blocks is approximately 40 inches. Overall accumulated error in the spacing of the blocks from one end of the 40-foot jig to the other cannot exceed 0.005 inch.

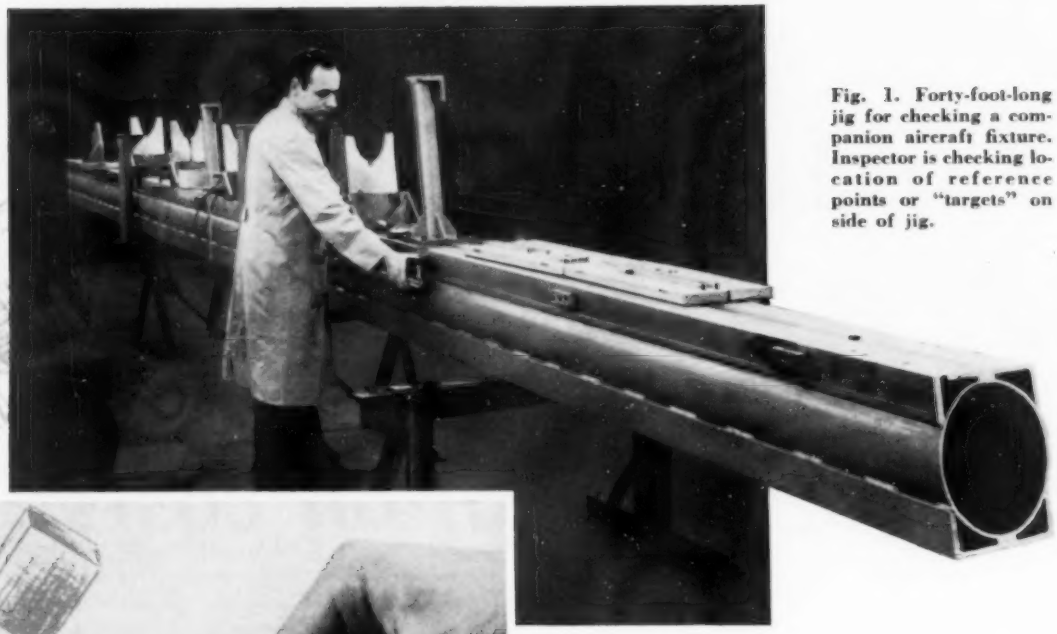


Fig. 1. Forty-foot-long jig for checking a companion aircraft fixture. Inspector is checking location of reference points or "targets" on side of jig.

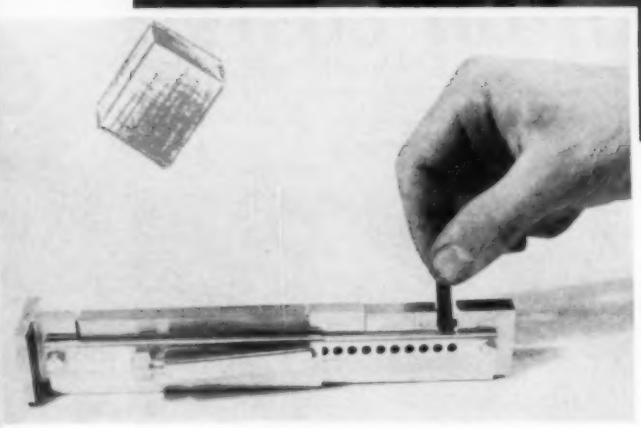


Fig. 2. "Building-block" gage. Gage blocks are inserted to make up fixed gage of required length. Thumbscrew squeezes blocks together.

Locating the Targets: The first step in locating the targets is to establish an accurate centerline along the top channel. Top targets are located along this center line. Location of the first target is determined with a building-block gage and a square. The position of the last target at the other end of the jig is established with a transit. After blueing the surface of the channel, a center line is scribed with long straightedges. Targets can now be spaced at regular intervals along the centerline and sides of the jig.

The approximate location of each target is determined with a scale. Targets are held in this location by a capscrew. The hole for the capscrew is drilled oversize, permitting the target to be moved for final positioning. When the final position of the target has been established by the building-block gage, the capscrew is tightened and holes are drilled so that the target can be permanently dowelled in position. Final location of the targets is held within less than 0.001 inch to limit cumulative error.

Gage Construction: The building-block gage, manufactured by The DoAll Co., consists of an end channel, an "extensional channel" and two end standards, fastened to the ends of the channels by dowel pins, *Fig.* 2. Gage blocks are inserted in the channels, which are then drawn together by means of a thumbscrew. The force exerted by the thumbscrew is sufficient to wring the blocks and end standard together.

Long gage blocks and long channels are used in the checking gage for the aircraft jig, making it possible to quickly assemble gages of the required lengths. A piece of bar stock clamped to two target blocks serves as a convenient support for these long gages when locating or checking the position of targets along the side of the jig.

Indicating Gage: Because of the extreme accuracy required, location of the targets is rechecked several times during construction of the jig. Formerly, this was accomplished by "feel" with fixed gages. Accuracy was questionable, since the "feel" of a heavy fixed gage is hard to evaluate. Use of a building-block gage having an end standard equipped with a dial indicator has eliminated this problem. In operation, the indicator is "zeroed" to one end of the standard.

As shown in *Fig.* 3, when a 3-inch indicating end standard is assembled into an inside height gage with two 4-inch blocks and a 1-inch end standard, a zero reading on the dial will indicate a 12.0-inch dimension. Turning the indicator block around in the assembly will make an indicating outside height

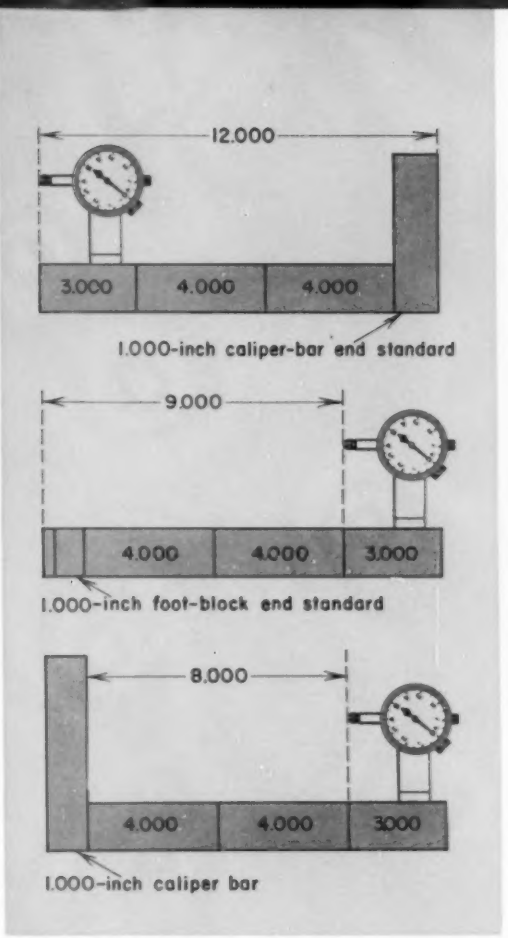


Fig. 3. Three setups using indicating end standard. Twelve-inch external indicating gage (top), nine-inch internal indicating gage (center) and eight-inch indicating snap gage (bottom).

gage with a nominal length of 9.0 inches. Substituting a caliper bar for 1-inch end block converts the assembly into an indicating caliper. A zero reading, in this instance, indicates an 8.0-inch dimension. The indicator can be front, side or end mounted to provide almost universal flexibility in constructing indicating gages.

The gage for checking the location of the side-mounted target blocks has a caliper bar end standard at one end and a front-mounted indicator assembly at the other, *Fig.* 4. Checking the location of the top targets is performed in the same manner, with gage blocks used to achieve the necessary height, as shown in *Fig.* 5.

Building-block gages provide three important advantages in the construction of large jigs. First, they provide gage-block accuracy. Second, they reduce gaging time. Third, it is possible to make up a gage for almost any application from a few simple components. This eliminates the need for maintaining a large and costly inventory of gaging equipment designed for specific applications.

Fig. 4. Checking location of a side target with building-block indicating gage.

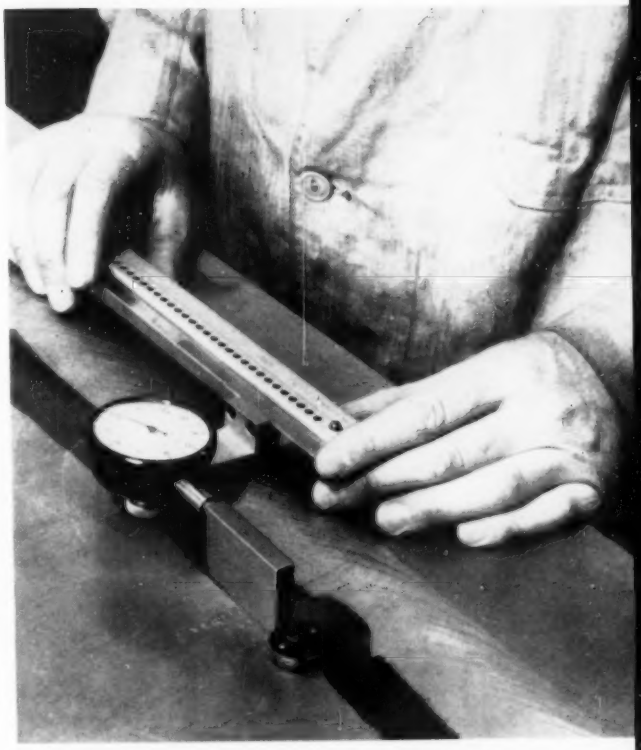
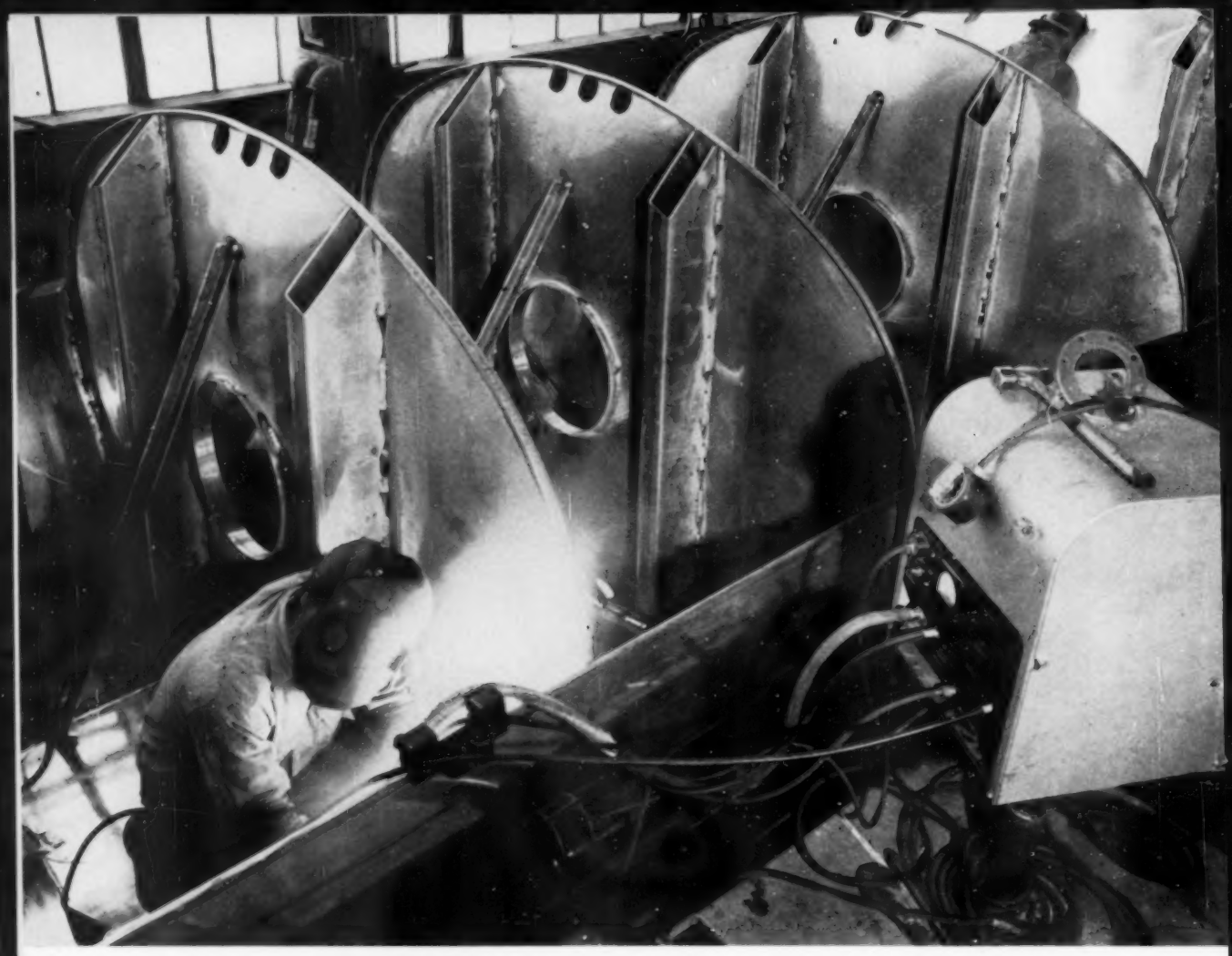


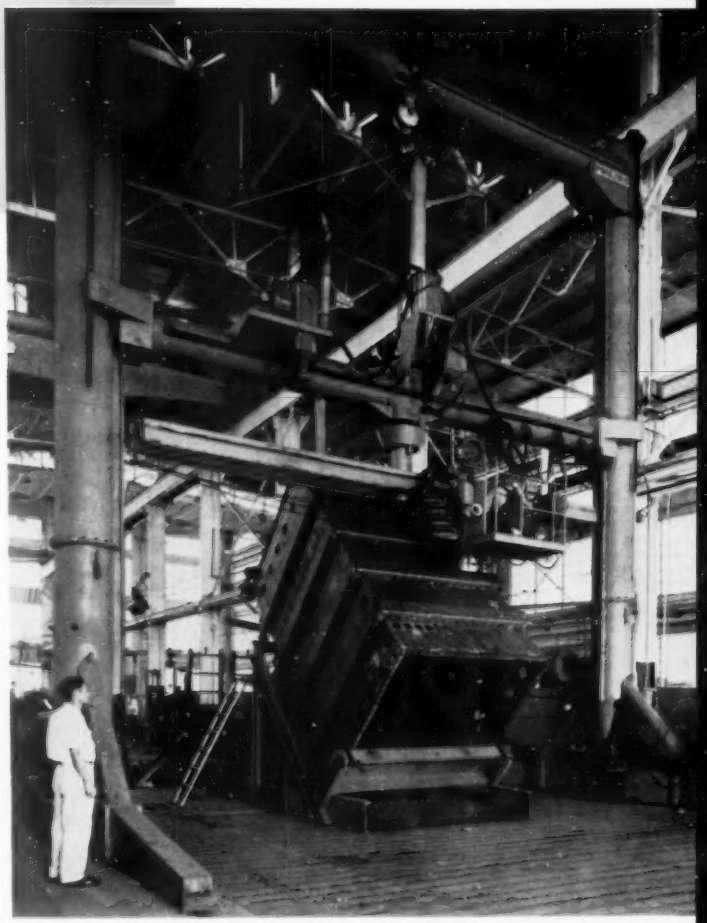
Fig. 5. Checking location of top target with building-block indicating gage. Since spindle of dial indicator is at higher level than target, gage block is placed between them to provide contact.



SEMIAUTOMATIC inert-gas arc welding is used in fabrication of tanks built by the Heil Co. Tanks, of 0.156-inch thick 5154 aluminum alloy, range up to 32 feet in length. Operator puts full lap welds on all joints. Argon gas supply, water cooling unit and the wire drive of the General Electric Fillerarc unit are mounted on a metal cart that can be moved within a fifty-foot radius of the generator. Automatic current regulation and constant arc length practically eliminate crawling in and out of the tank to adjust the generator.

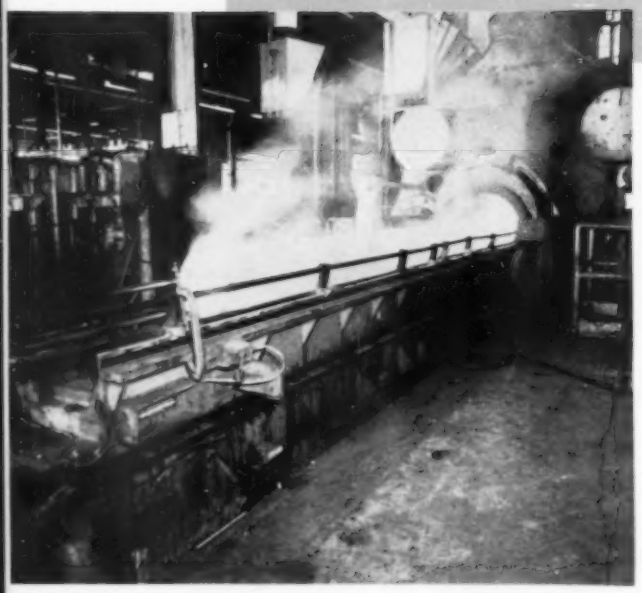
TOOLS at work

MECHANIZED welding of corners facilitates fabrication of bridge members at the American Bridge Div., U. S. Steel Corp. Basically, the welder is a manual Lincolnweld unit, modified and mounted on a special carriage. Reel for the welding wire is attached directly to the carriage. A large clamp holds the flux cone and an additional hopper serves as a reservoir for extra flux. The carriage straddles the corner and has idler wheels on one side, drive rolls on the other. Open-corner fillet welds are made at speeds exceeding 12 inches per minute and the unit makes welds as long as 40 feet without stopping.

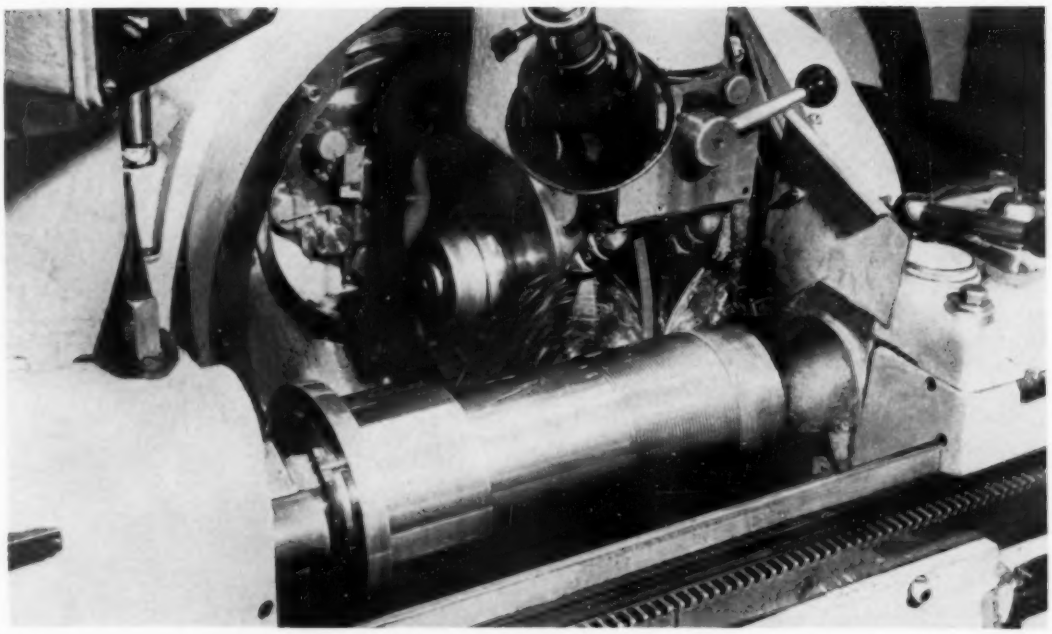


SELF-PROPELLED Gantry type welding positioner stands 30 feet high and is 38 feet wide at the base. The positioner travels to job location and welds seams, top rings, brace bars and bases in the fabrication of transformer tanks. Operator travels with the welding head and has visual control of welding at all times. Vertical and horizontal positioning of the head is operator controlled. Uninterrupted welds up to 20 feet long can be made in any direction without movement of the Gantry, which is self-propelled on rails running the length of the shop floor. Manipulator was made by Pandjiris Weldment Co. and is used in Wagner Electric Co.'s Transformer Tank Fabrication Plant.

TOOLS at work



HEAVY-WALL SEAMLESS TUBING is extruded from stainless and chrome moly steel alloy billets at Metals Processing Div. of Curtiss Wright Corp. Extrusion process improves transverse properties and results in a high ratio of tensile properties to ductility. The 12,000-ton press can produce extrusions up to 60 feet long. Maximum diameter of extrusions is 20 inches.



CLOSE-UP VIEW of thread grinding operation on hexagon socket head capscrew. Screw, designed for use in the supersonic nozzle assembly of a propulsion wind tunnel, is 4½ inches in diameter, 10½ inches long. Manufacturer is the Cleveland Cap Screw Co.

AUTOMATIC SCREW MACHINE at Chrysler's Kokomo plant is largest in the automotive industry. This machine, at the start of the annulus gear production line, performs rough and semifinish operations on both the OD and ID of gear blank, finish chamfers both ends of the ID, faces the end, and cuts the blank off from tube stock. Operator is gaging a gear blank before passing it down chute to next operation. Machine was built by Acme-Gridley, Cleveland, Ohio.

GENERATOR ROTOR FORGING is ultrasonically tested at General Electric Co.'s Large Steam Turbine-Generator Dept. After a slight surface cut has been taken on the forging, it is slowly rotated while a device that transmits and receives ultrasonic vibrations is passed over the surface. Vibrations sent out by the transmitter are reflected back to the receiver by flaws. Depth of discontinuities in the forging is indicated on dial of tester.

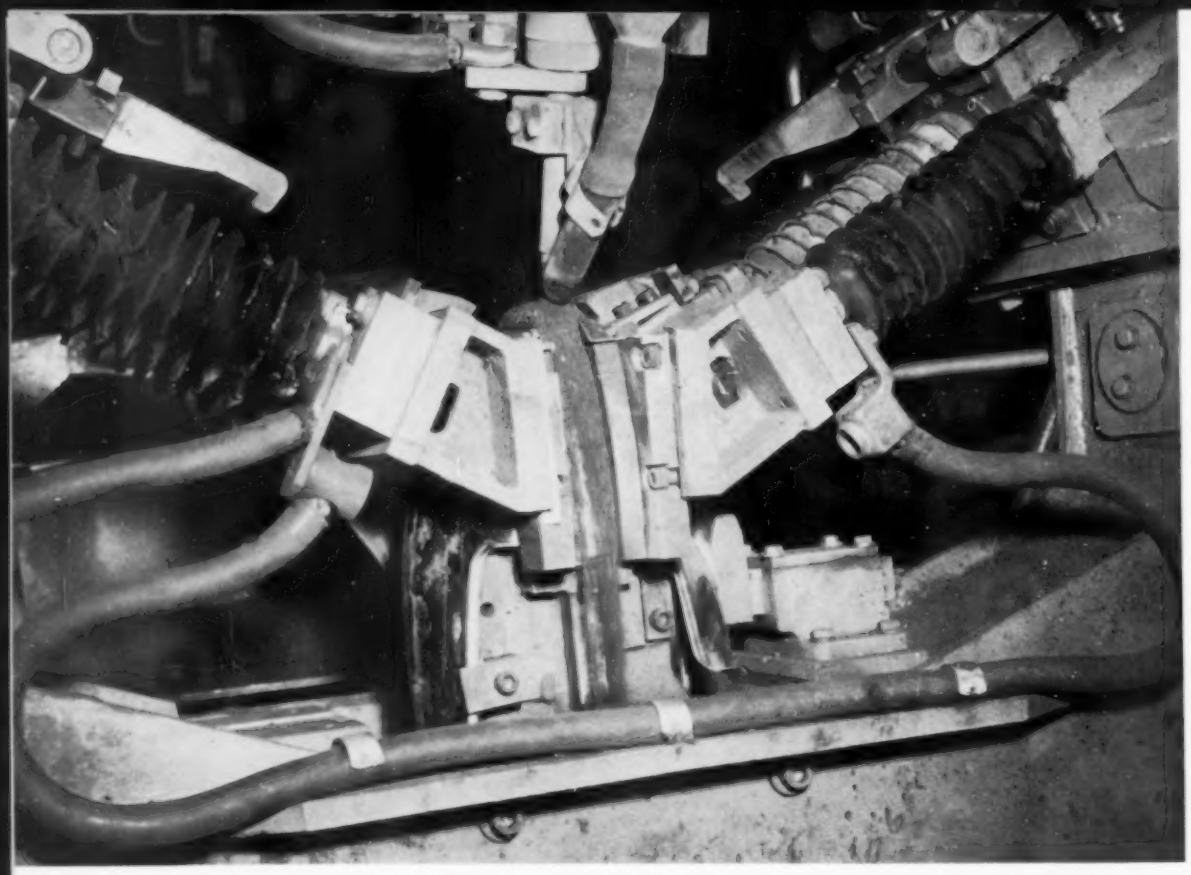


Fig. 1. Completing the automatic arc weld on the nose of a bumper guard clamped in a rocking fixture. Flux from the welding head covers the arc.

WELDING avoids deep

Pairs of stampings are welded to form a shape too deep and complex for drawing in one piece. Batteries of welders produce seams around a nose contour and across flats.

PRODUCTION OF BUMPER GUARDS in high volume was found to impose difficult forming problems which were solved by producing the parts in halves and welding them together in automatic machines, *Fig.* 1. The problems become apparent when examination is made of the shape of the guards shown in *Fig.* 2.

Inasmuch as each guard is made from 0.090-inch steel sheet, and is deep from nose to heel with an undercut at the heel, drawing in one piece is not feasible. Accordingly, a two-piece guard is required. Even then, a fairly deep draw must be made in each component.

For the first welding operation, a pair of stampings is placed in automatic welding machine fixtures, so mating edges are held in close contact by Alnico magnets. Then, a short weld is made along the top of the pair. A vertical portion of the weld is skipped in this operation but the weld is continued around the curved nose, a fillet and a flat portion. Efforts are made to avoid pinholes because the entire exterior of the weldment is polished and plated later.

Because of the irregular contour, two types of special welding machines are required to make the welds. After the initial welds in the first welder, the weldment is placed in the second type of machine that joins the two welds made in the first machine. Results of this procedure can be seen on the completed weldment, top center in *Fig.* 2.

Fig. 2. Stampings for a rear bumper guard. Left to right, inside and outside after automatic arc welding and after dressing off the weld with added press operations and plating.

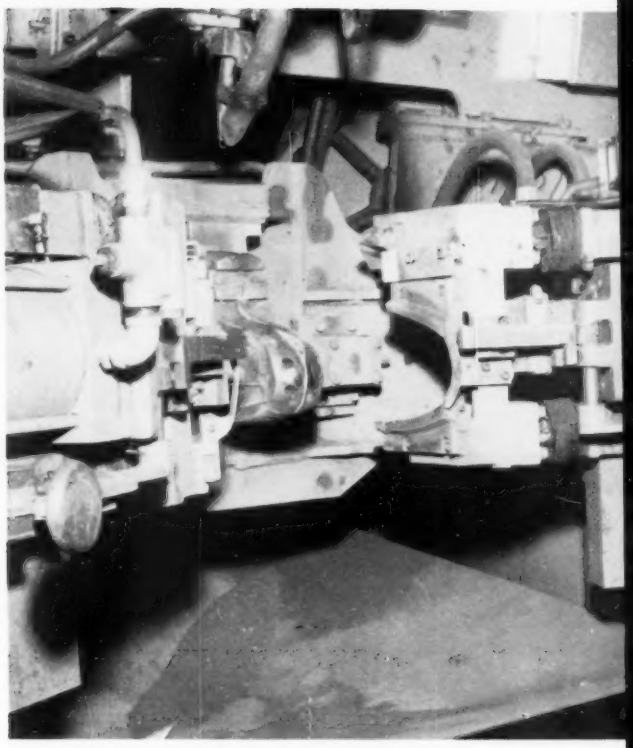


Fig. 3. Close-up of one trunnioned fixture for the first automatic arc welding operation on bumper guards as it appears before loading over backups of copper alloy and with clamping elements retracted. Below is the hopper that catches unfused flux.

drawing problems

An empty fixture is shown in *Fig.* 3. No. 2 copper alloy components are inserted in the fixture to back the welds. After the fixture is loaded by hand, the operator presses a button and air clamps advance to press the clamping elements inwardly from right to left. They help to force the mating edges of the two components together and to hold the edges flush.

Above the fixture is an automatic Lincoln Electric submerged-arc head that feeds the low carbon, 3/32-inch welding wire and flux while welding proceeds. As soon as the fixture is locked, the head is moved down by an air plunger, strikes the arc and makes the short horizontal weld as the fixture is moved backward along with the weldment. As this part of the weld is completed, the head moves slightly to weld a short external fillet.

At this point, the current is shut off, the fixture with the weldment moves backward and the head is lowered, without welding, until the electrode contacts the nose portion. Thereupon, the welding around the nose starts and continues until the weld is completed. *Fig.* 1 shows the lower end of the head as it reaches the tip of the nose, the fixture having rocked on its trunnions to this position.

Electrode wire tip and arc are covered by the granular flux. Excess flux falls into a hopper and thence onto a shaker screen. Fused particles of flux are caught on the screen and are shaken off for collection and regrinding. Other granules pass through the screen and feed to an elevator that lifts them to a flexible hose opening, whence they feed back to the head hopper for re-use.

In *Fig.* 4, the fixture is shown from the rear after it has finished its backward rocking and has opened. At this instant, an air operated ejector, moves to the position shown, latches to the weldment and pulls it out of the fixture and onto a conveyor for transfer to the next operation.

When the fixture reaches the position shown in

Fig. 4, the welding head has been elevated automatically to clear the ejector and is in a position to start a new cycle. In *Fig.* 5, flux fused to the weld can be seen covering the short weld, now at the bottom, and the weld around the nose. This fused flux drops off or is removed manually, as the weldment is handled later. As soon as the weldment is ejected, the fixture automatically rocks back 180 degrees, where it stops and is ready for reloading and to repeat its cycle.

Once the machine cycle starts, it continues automatically, unless stopped by the operator. The setup is automatic except for hand loading and starting of each cycle.

To insure good welding from the instant the arc is struck, each machine has a high-frequency starting transformer. The welding heads are adjusted to hold a 1/16-inch arc gap. At the start, about 350 amperes feed momentarily, but normal flow after starting is 300 amperes at 24 to 25 volts, automatic adjustment being made by a time-delay relay and a potentiometer.

Motors for driving the fixtures through worm gears have adjustable speed control and are set to rotate initially at a speed slightly below that attained thereafter. This helps to improve penetration at the start of both welds. Special brakes have been added to stop the fixture-drive motors quickly. Any tendency to coast can result in overloading the reversing motor. Cycle time is presently about 31 seconds but a decrease to about 26 seconds is anticipated. Vertical motions of the head are performed by an air cylinder whose solenoid operated valves respond to limit switches.

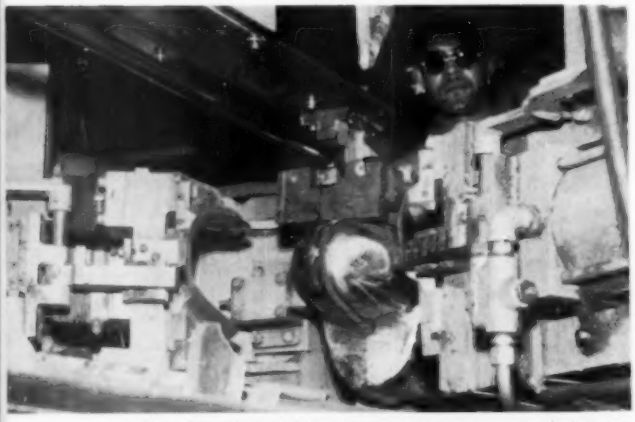


Fig. 4. (above) Bumper guard as it appears with the intermittent weld completed and still covered with fused flux. Fixture clamps have retracted and the air operated ejector above is about to pull the weldment out of the fixture.

Fig. 5. (right) Automatic machine that completes bumper guard arc welding on a three-station indexing fixture. One piece is unloaded and another is loaded while welding proceeds at the remaining station.

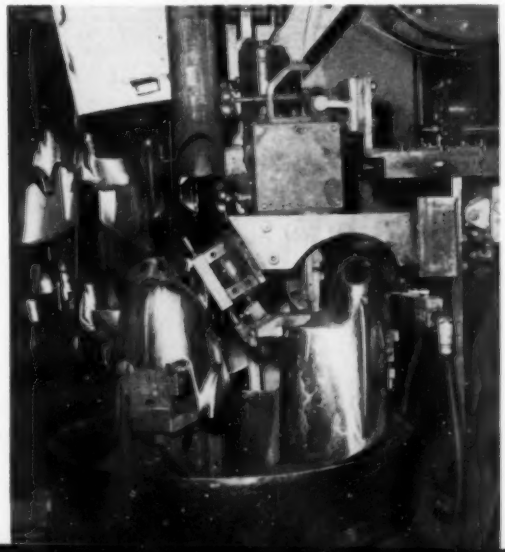
Weldments discharged from the first operation welders are carried by a conveyor to the second type of automatic welder where the welds already made are joined by a short straight-line weld across a flat surface that is shown horizontal in *Fig.* 5. Each of these machines has an indexing table carrying a three-station fixture. At each station, there is a copper alloy backup that comes below the joint to be welded.

When indexing occurs, the workpiece enters the welding station (at left in *Fig.* 5) where the piece is automatically air clamped. Thereupon, the automatic head is lowered and starts to weld as soon as the 1/8-inch mild-steel electrode contacts the workpiece. Flux starts to feed and continues to submerge the arc during the weld, which is made as the head is traversed by an air plunger at a speed controlled by a hydrocheck.

Welds made in the second machine are much shorter than those made in the first machine, the cycle time being about one-third that in the first machine. It is about 10 seconds. Heads in the indexing machines make welds at 24 to 25 volts and 280 amperes. No transformers for increased voltage in starting, like those on the first battery of welders, are used on these machines.

At the end of the weld, current is shut off, the wire is slightly retracted and the head is elevated and moved back horizontally to the starting position. During this interval, the weldment is unclamped and is indexed to unloading position as the next workpiece indexes to welding position. Then the operator removes the completed weldment and hangs it on the conveyor for advance to the belt polishers and grinders in which the weld is dressed off and polished flush with the surface.

The interior is inspected and, if there are any beads or run-through in welding, they are ground out because the weldment must fit into dies that do redrawing, embossing and piercing. As these operations involve portions of the weld, it must be strong and must not crack. This necessitates good welds and complete penetration.



Tool Engineering

REPORT

subzero temperatures

facilitate production processes

By Robert A. Wason*
Associate Editor

When workpiece materials or coolants are chilled to subzero temperatures, cutting times are reduced and tool life is increased. Low-temperature treatments can stabilize and improve metallurgical properties. Applications in finishing, assembly and inspection are also discussed.

As NEW CHILLING TECHNIQUES and cooling equipment are developed, subzero- temperature processing of metals, rubber and plastics is being increasingly used to solve specialized production problems. One well-known example is the removal of flash from plastic 0-rings by tumbling them in a barrel with dry-ice pellets. The thin flash, made brittle by the low temperature, breaks off cleanly during tumbling. Thicker sections of the 0-ring do not cool through during the brief exposure to reduced temperatures, so the rings themselves do not become brittle enough to crack while being tumbled.

This type of application is simple; it solves a problem effectively and the savings over manual deflashing are considerable. Other uses of cold, *Fig.* 1, are of equal interest and of considerably wider utility. Low temperatures facilitate some machining operations, for instance. They make it possible to make certain types of expansion fits without workpiece damage. "Cold treatment" also improves metallurgical properties.

Machining Process

Reduced-temperature techniques have many applications in machining processes. Cutting tools can be given subzero cooling treatments to improve their properties, and workpiece materials can be cold treated for easier machining. In addition, ordinary

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cutting fluids can be cooled to maintain cooling efficiency, and subzero coolants can be used to increase the efficiency of cutting operations.

Chilling of aluminum castings prior to machining has brought substantial savings to the Power Products Div., Canadian Westinghouse Co. Difficulty had been experienced with heat-treated aluminum castings "moving" during and after machining. To live with this situation, tool engineers specified that critical parts should be machined three times, with a 24-hour wait between operation.

After chilling, parts are now set up only once. They are rough machined and then immediately finish machined. On a single order involving several hundred castings of 11 different types, savings of close to $40,000 were recorded because of reduced handling and setup costs. Because of this success, the same technique is being used on bronze castings.

After a subzero quench, 4130 chrome-molybdenum steel parts are rough trimmed on a band saw. Band sawing time per part decreased 50 percent while the cutting life of the band increased 300 percent. Similar results have been obtained when sawing 0.08-inch-thick titanium after instituting a subzero quench.

Drilling and routing time has been substantially reduced after 1½-inch-thick 75 ST 6 aluminum parts are given a subzero quench. Polishing of the parts is unnecessary because the finish is excellent. Treatment of the workpiece shows improved results on the cutting tools too. Tool life is considerably increased.

A 72-inch broach has been hardened and stabilized by subzero chilling at –125 F. Life of the tool has increased 100 percent. As a result of the transformation of austenite to martensite, flaking of the cutting edge has been almost eliminated. This same result can be anticipated for all cutting tools. Kearney & Trecker Corp. uses a deepfreeze unit with a holding temperature of –120 F for treatment of HSS tools. Batches of 50 lb of drills and milling cutters are kept in the unit for one hour. In that time, the convection fluid, liquid dichloro-methane, equalizes the temperatures. After this treatment, the tools are a few points harder on the R_c scale, sometimes as much as 10 points.

Stock HSS tools that have been hardened and finish ground may be chilled with definite improvement in cutting efficiency. The best results are obtained, however, when the cold treatment is used during the hardening and tempering cycle. The improvements possible can save a lot of setup time.

Tools or dies that have been improperly heat treated or that are slightly undersize can frequently be salvaged through a subzero chill if such a step was not included in their manufacture. The slight amount of growth produced by the transformation of some austenite to martensite can bring the tool to required size. If the tool is then oversize, it can be ground easily without danger of cracking. Because this transformation has other benefits, tools can be used with a higher hardness and have the same strength, or they can be used with the same hardness but be stronger.

Low temperatures can be used to provide economical solutions to little problems, the kind that can be the most bothersome. The Locomotive and Car Equipment Dept., General Electric Co., uses small quantities of a variety of rubber bushings. Requirements are not sufficient to justify mold and setup costs. This problem was solved by buying one master bushing blank size, freezing the blanks and

—Photo courtesy Douglas Aircraft Co., Inc.

Fig. 1. Five-gang milling cutter used with a subzero coolant to straddle mill a steel clevis. Standard HSS, staggered-tooth side-milling cutters are used.

machining to required dimensions. This has been economical because blanks are purchased in reasonable quantities and liquid nitrogen is available as a by-product of the manufacture of oxygen.

A crock, partially filled with sawdust, is used to hold several bushings. Liquid nitrogen (–319 F) is poured into the crock carefully, to avoid direct contact with the parts. They crack if too rapidly cooled. The sawdust helps prevent too rapid evaporation of the nitrogen. The crock is then covered for 5 to 8 minutes. Too long freezing can also cause cracking.

After freezing, the blanks are removed from the crock, one at a time, and machined on a turret lathe. *Fig.* 2. If operations are performed quickly, all machining can be done with one freezing. Holes are drilled with standard metal-cutting drills, not altered in any way, and forming and cutting off are done with standard HSS tools. Chips are long and continuous like wood shavings. Sufficient part accuracy is easily obtained.

Aluminum honeycomb parts are held for machining by freezing them onto refrigerated work fixture platens. Plain tap water is used as the adhering agent at one Northrup Aircraft, Inc., plant. Similar jobs at another Northrup plant are being done with a wax-like substance that freezes at a higher temperature. Since maintaining low temperatures is not inexpensive, any reduction of requirements can save money.

In other companies, fragile honeycomb is frozen into a block of ice. In this way, individual cells are supported against crushing forces and the honeycomb is also held onto the refrigerated platen by the ice. All types of straight and contour machining can be done with workpieces secured in this way.

Convair-Fort Worth has found that refrigerated platen machines, with an 8-minute freeze-defrost cycle, can equal the production milling rate of 10 indexing platens using adhesives to secure workpieces. The "ice platen" has a maze of passages through which cold and hot fluids are circulated cyclically. This platen is also being investigated for holding plates, castings and forgings for milling, drilling and profiling. Foam rubber can be machined with such a setup, as can soft plastics, and woven and felted fabrics.

Cold Cutting Fluids: Continuous operation and the heat absorbed by cutting fluids during heavy cuts have brought about special devices to remove heat from cutting oils. Heat removal is usually a problem on individual machines rather than at a central location. Heat exchangers are easy to install and simple to control but are more costly than water-cooling coils or tower sprays. Coolers can be moved from one machine to another as needed.

Refrigeration is more essential with straight oils than with water emulsions because the specific heat of oil is 0.48 while that of the emulsion is almost 1.0. Emulsions seldom run much above room temperature. If oil absorbs the same amount of heat as the water solution, its temperature will rise twice as high for equal volumes. Also, with oil, there can be no evaporative loss of heat as there is with water solutions.

Tools showered with refrigerated cutting fluids cut with more precision and at faster speeds. They need fewer regrindings; they stay sharp up to 20 percent longer; and result in corresponding reductions in down time. In one shop, cooled fluids used on an automatic lathe tripled production. Dur-

Mechanism of Transformation

Positions of steel atoms change during heat treatment and because of this steel parts can be hardened. In the annealed condition, steel atoms form body-centered cubes—an atom at each corner of a cube and one in the center. When heated to about 1350 F, austenite is formed and steel atoms are arranged in face-centered cubes. Volume of the part is less because more atoms are needed for a basic cube. (These volume changes are not associated with thermal expansion and contraction.)

If austenite is properly cooled, it will transform to the harder phase, martensite. Martensite is a body-centered tetragonal structure—atoms are arranged as in the annealed condition but one dimension is elogated. Part volume increases because of the redistribution of atoms. Final size is greater than when annealed because of the elongated shape of the atom structure.

After steels are tempered, varying changes can occur. Some of the retained austenite will transform to martensite, causing growth, and the martensite will start to decompose to a product that has a more nearly cubic form, causing contraction. This conflicting size change will probably result in increased part size.

As practiced by Greenfield Tap and Die Corp., stabilization can be achieved by subzero chilling. This step transforms a maximum amount of austenite so there is less to cause future growth. Decomposition of martensite can be reduced to a minimum by proper tempering cycles.

ing the first hour of operation, rejects dropped from 30 to 5 percent.

Using a cutting fluid with a temperature of –40 F, tests were made of a milling operation on a normalized 4340-steel forging, *Fig.* 1. With standard coolant techniques, 35 pieces were turned out per day and 60-65 pieces were made per grind. With the cold fluid, 80 pieces were made per day and 169 pieces per grind.

Another cut on the same forging did not show as good results, primarily because of inability to get the coolant into the cut in sufficient volume. This leads to the conclusion that the cold temperature is mandatory for success. A further demonstration of this conclusion was seen in still another test. The feed per tooth was reduced and the surface feed was increased. Temperature of the operation started to rise and results fell off rapidly. By applying a subzero compressed-air stream on the cutting edge of a carbide milling cutter, another company increased tool life by more than 400 percent. Surface finish was also improved.

Through use of a small jet of liquid carbon dioxide at high pressure, cooling action of the cutting fluid can be restricted to the tool. This technique offers an opportunity for damatically extending tool life, especially when working materials that are prone to chill-hardening. Since the newly formed chip is not touched by the coolant, it remains soft and plastic until it clears the tool.

During a program to develop methods for routing steel, Douglas Aircraft had some success with various types of cutters and cutting fluids. However, cutter life was so short the process was almost impractical. The next step was to force a subzero coolant stream onto the carbide cutter and the part. Where the best previous result had been 3 completed parts per grind, this method gave 25 parts for 4130 and four of titanium. Results were just as good when the workpiece was changed to full-hard 18-8 stainless. In another test, 4340 was heat treated to 260,000-280,000 psi. This hard material was cut at the same depth and feed as with normal coolants but the turning speed was successfully increased from 50 to 345 rpm.

Routing of laminated phenolic sheet is considerably improved through use of a subzero coolant. Parts can be cut "just like butter," *Fig.* 3. Cutting time is halved, and deburring and polishing are unnecessary. The router bit lasts considerably longer.

Expansion Fits by Cooling

Shrink fitting has long been practiced in industry. With this procedure, the enclosing part is heated until it expands sufficienly to accommodate the penetrating part. Where tight fits are required, this procedure requires high temperatures and perhaps the use of a press to complete the assembly operation. High temperatures can result in metallurgical changes, distortion, reduction of hardness, oxidation and general scaling. This makes finishing and

—*Photo courtesy General Electric Co.*

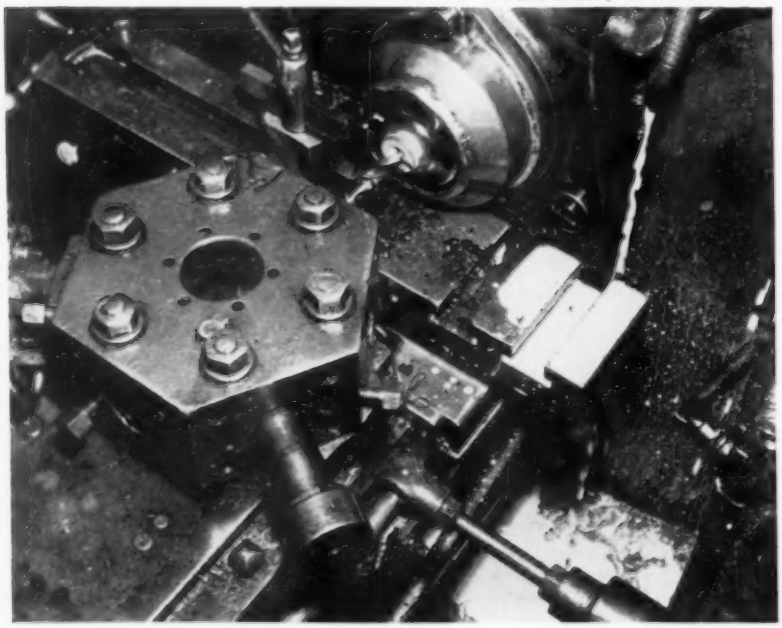


Fig. 2. Frozen rubber bushing blank is drilled to size. Parting tool is ready to finish the correct form on the bushing. Standard metal-cutting tools are used.

straightening operations necessary. Dimensional changes during heat-treatment also cause trouble.

To prevent such overheating troubles, some companies heat to a lower degree and complete the assembly by mechanical force. This can lead to physical damage, unnecessary strains and scrap. The handling of hot parts can introduce problems to the production operation. Also, under certain conditions, heating of female parts can actually cause contraction. This generally happens with parts having large heavy rims and where heating is localized. Since the thin metal surrounding the hole has no place else to go, it moves inward instead of outward as expected.

Through use of subzero cooling techniques, many of the problems formerly associated with shrink fitting have been avoided. Parts at low temperature are easier to handle than hot parts; there is less chance for metallurgical changes to occur; physical shape does not change and oxidation does not take place.

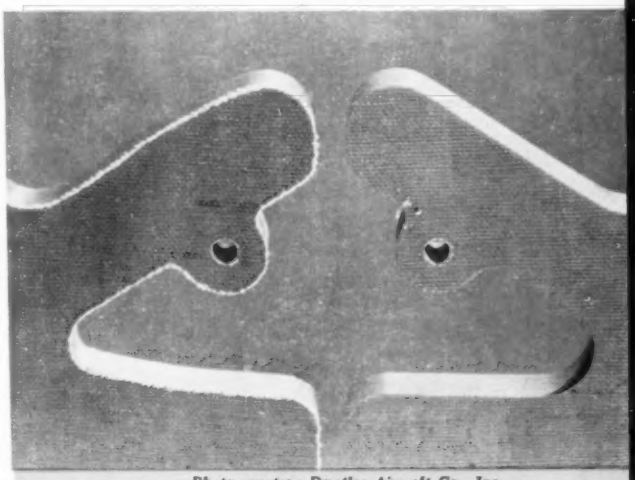
Expansion fitting usually involves only the chilling of the inserted part. Where both techniques are combined, all the equipment should be grouped together. This equipment sometimes includes presses or rams, not for pressing pressures but to expedite the assembly operation. When heating is used with chilling, temperature levels are much lower and parts are not damaged.

The use of reduced temperatures, so that the internal part subsequently expands to fit the enclosing part, can prevent scoring that might occur in standard press fits. This is especially important where parts are protected by plating. Expansion fits result in considerable savings both because of less expensive production methods and reduced scrap.

Although the method was dropped when aluminum bushings were replaced by cast iron, expansion fits of the bushings in track rollers were successfully accomplished by the Caterpillar Tractor Co. The freezer unit, *Fig.* 4, was located next to a conveyor line. As track rollers passed the freezer, a bushing was removed from the freezer and dropped into the roller. Each of eight compartments in the freezer holds 28 bushings.

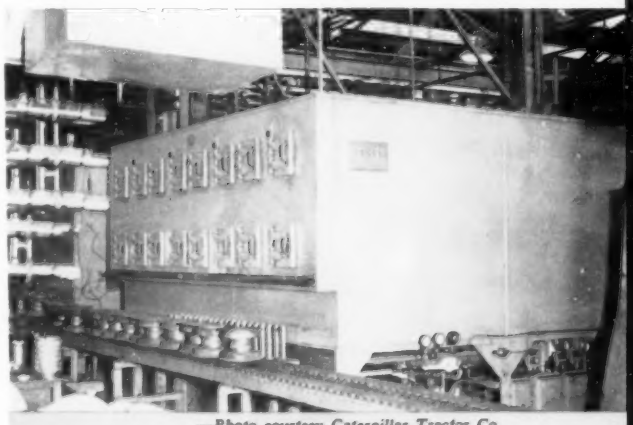
Bushings roll on a track from the loading door at the top of the compartment to the discharge door at the bottom. Final part temperature is −100 F after the two-hour trip through the compartment. Capacity of this setup is about 112 pieces per hour. Bushings, with a diameter of $3\frac{5}{8}$ inches and having a $2\frac{1}{8}$-inch hole, shrink between 0.003 and 0.004 inch at the reduced temperature. Some representative shrinkage values for various metals are shown in the accompanying table.

A set of ten bushings, 14 inches long and ranging in diameter from 7 to 10 inches, is used in planer beds made by the Hypro Div., Giddings & Lewis Machine Tool Co. For a long time, these bushings were inserted with the aid of draw bolts. It took 400 minutes to insert one set. By changing to reduced-temperature techniques, the complete set can now be inserted in 70 minutes. A freezer is used that holds about 2000 pound of bushings and re-



—Photo courtesy Douglas Aircraft Co., Inc.

Fig. 3. Routed samples of laminated phenolic sheet. One-half inch sheet at left was cut normally. Part at right was cut with subzero coolant and shows no burrs.



—Photo courtesy Caterpillar Tractor Co.

Fig. 4. Aluminum bushings are processed through the eight compartments of this freezer so they will shrink sufficiently to drop into the rollers carried on the conveyor.

duces their temperature to –20 F. Under these conditions, the diameter of a 9-inch bushing is reduced by 0.009 inch.

One good thing about the use of expansion fits is that the time-consuming operation comes before assembly rather than after. Units that are to be shrunk have to spend considerable time at the reduced temperature but warm up and expand quickly. For example, the Iowa Mfg. Co. shrinks bearing cups by freezing for four hours. Diameters are reduced between 0.002 and 0.003 inch. After insertion, the cups are tight in from ½ to ¾ minute. This reduces the number of holding fixtures required.

Another use for reduced temperatures is the reverse of the expansion fit. On occasion, it is necessary to remove a bushing that has been inserted with an expansion, press or shrink fit. This can frequently be best accomplished by inserting a cup type container in the bushing and filling it with a low-temperature fluid. As in all operations involving reduced temperatures, adequate precautions should be taken to prevent injury to personnel.

According to engineers at the Eclipse-Pioneer Div., Bendix Aviation Corp., mechanical refrigeration units, with temperatures down to –150 F, are more economical than dry ice or liquid air, and are easier to handle and control. Where requirements are not high, cooling may be done by packing parts directly in dry ice or immersing them in a liquid that does not freeze at –100 F. This liquid is held in a container packed in dry ice. Immersion in liquid air gives temperatures to –100 F. Liquid nitrogen is used for temperators to –323 F. Careful thought should be given to container design to minimize evaporation.

Liquid nitrogen is best suited for chilling small parts in small quantities. As soon as a part is dipped in a container of liquid nitrogen, a gaseous layer covers its surface so that chilling does not take place too rapidly. As the temperature of the part drops, boiling occurs. When the part is at the same temperature as the bath, boiling stops, which provides a built-in temperature indicator.

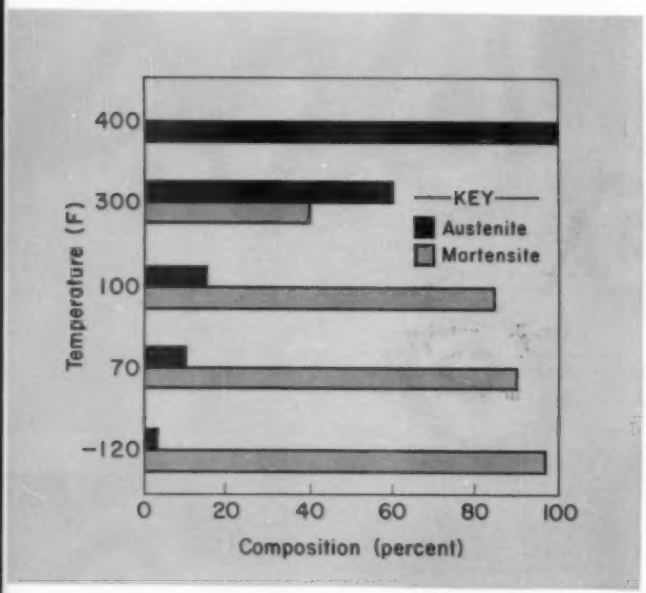


Fig. 5. Chart of the typical transformation of austenite to martensite in an alloy steel as temperature is reduced after hardening. Hardening temperature is 2200 F and normal heat treating would stop at 70 F.

Metal Shrinkage for One-Inch Diam. Rod

(from 70 F to temperature indicated)

Metal	Temperature –70 F	Temperature –125 F
	Shrinkage (inch)	
Tool Steel (steels)	0.0080	0.00130
Phosphor Bronze	0.00120	0.00180
Aluminum Bronze	0.00120	0.00180
Brass	0.00140	0.00200
Aluminum	0.00170	0.00230
Magnesium	0.00170	0.00235

—Data Courtesy Webber Appliance Co., Inc.

Thermal Treatment of Steels

All steels retain a certain amount of austenite after routine heat treating procedures, *Fig.* 5. High-alloy steels retain the most because the austenite in them is slow to transform to martensite. Thus, the effects to be gained by subzero chilling depend on the type of steel. There must be austenite that can be changed to martensite if big effects are to be noted. Prior heat treatment also influences the amount of transformation possible through chilling.

It is desirable to change austenite to martensite because the steel will be harder, stronger and more ductile. A typical thermal treatment for high-speed steel, as used by the Industrial Steel Treating Co. for example, includes preheating, heating to 2150-2450 F, quenching to 200 F, air cooling to room temperature and then chilling. Following the chill, HSS parts are tempered at 1000-1100 F. Time at the subzero temperature is not important for most steels. It is only necessary that the required low temperature be reached throughout the part.

Since overchilling is not harmful, steels of different cross sections and of different types can be chilled at the same time. It is necessary, however, that the load be kept chilled for a long enough time to insure that the heaviest sections and the types requiring the lowest temperatures reach their neces-

sary temperatures throughout.

Where parts have been thermally hardened throughout their cross sections or where they have sharp corners, to prevent cracking it is best to use several cycles of chilling and low-temperature heating. According to tests performed by the Sub-Zero Products Mfg. Div., Deepfreeze Distributing Corp., parts should not be held at room temperature between the quench and the chill. One hour can be detrimental and 10 hours can reduce the efficiency of the subzero treatment by as much as 50 percent.

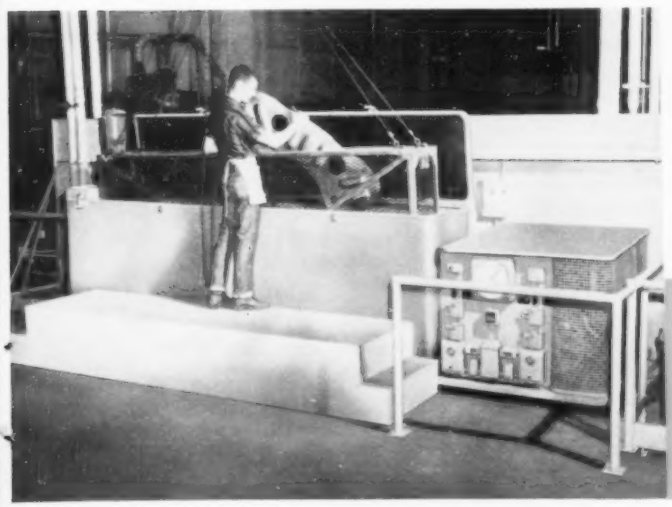
Proper subzero treatment procedures specify a tempering step after chilling. This has the effect of setting the structure, hardness, strength and ductility properties. When austenite has been changed to martensite and the part has been tempered, cracks will not result from grinding. This is probably because austenite expands about 50 percent more than martensite and if there isn't much austenite, stresses in the workpiece are not as high. Since austenite is denser than martensite, parts should not be finished to size until after transformation. Part growth during transformation could destroy machining accuracy if parts were finished first.

Studies into the desirable characteristics for stainless steel and the availability of new refrigeration equipment—a typical new machine can lower 250 lb of stainless steel per hour from +80 to –120 F—led to development of a new class of stainless steels. These semi-austenitic steels (17-7PH and AM-350 are examples) require a –100 F chill as part of their thermal treatment cycle. As annealed, these alloys have an austenitic structure. The transformation point is below room temperature. Parts are annealed at 1700-1750 F, chilled to –100 F and tempered at 750-900 F. With such a treatment, they achieve full hardness. (These steels can also be hardened by double-aging or precipitation methods but results are better with subzero chilling.) The Columbus Div., North American Aviation, Inc., reduces hand forming time by transforming austenitic stainless steels, *Fig.* 6, through use of mechanical refrigeration.

Stabilization: Although transformation of austenite to martensite is desirable because of the changes it produces in strength and hardness properties, it is equally valuable because it stabilizes the steel. Several hours of subzero chilling can achieve a degree of stability that would otherwise only be possible by up to seven years of atmospheric aging.

Practically all steels, *Fig.* 7, cast iron, and aluminum castings and forgings can be stabilized if subjected to alternate warming and chilling cycles, *Fig.* 8. Each type of metal has a cycle that is best for it, and time and temperature limits should not be changed indiscriminately.

Precision parts such as beds and ways for lathes, arbors, mandrels and gages can be quickly and effectively stabilized so they will retain their sizes over normal temperature ranges and through



—Photos courtesy Cincinnati Sub-Zero Products

Fig. 7. (above) Alloy steel bar is about to be stabilized at low temperature. Final finishing after this step will result in high accuracy.

Fig. 6. (left) Mechanical refrigeration unit used for the stabilization of austenitic stainless-steel parts and production tools. Hand forming is reduced when parts are stabilized.

normal use. Final finishing of such precision parts is done after the structure has been stabilized. Parts are usually rough ground to within 0.002 inch of final size before stabilizing. For such precision parts, the gains through metal treatment at subzero temperatures—higher hardness, higher strength and good ductility—represent an added benefit.

In addition to cold treating gage stock, gagemakers are subzero chilling the lapping flats used to finish gages. Plate accuracy is maintained for

—Photo courtesy Douglas Aircraft Co., Inc.

Fig. 8. Desirable thermal shocks can be given to workpieces by cycling them through vats of boiling water and subzero mixtures.

several days after stabilization, which contrasts sharply with the several hours' life of a plate without such treatment.

Delayed Hardening

Because solution-treated aluminum alloys age harden at room temperature, almost immediately after quenching, they must be used right away. Since such immediate use would be difficult to schedule, especially in aircraft production, subzero chilling methods have been devised. Rivets and blanks for punching or forming can be stored in low-temperature freezers and used as needed. At temperatures of about –50 F, parts can be retained for several weeks. At –20 F, 24S rivets can be kept for only three days and must be used within 30 minutes after removal from the freezer.

Special problems require special methods but the techniques are all similar. For example, it was most practical to fabricate DC-8 Jetliner wing skins at the Alcoa Davenport, Iowa plant and heat treat them there. However, they are assembled at the Long Beach, Calif. plant of Douglas Aircraft Co., Inc. Age hardening had to be arrested but wing skins are 50 feet long and 10 feet wide. Through special packaging procedures and the use of flat cars refrigerated with carbon dioxide, wing skins arrive in good condition after their long trip.

Forming operations can be done through the use of reduced temperatures that could not otherwise be done. Nonheat-treatable stainless steels, for example, can be worked to advantage at reduced temperatures. The lower the process temperature, the higher the ductility of the metal for the same strength so that complex shapes can be formed. Properties imparted to stainless steel by working them at subzero temperatures are retained at temperatures up to 800 F. The processing is not difficult because, if the workpiece is sufficiently chilled, regardless of the temper, it is not necessary to cool the tools or the atmosphere surrounding the part.

Stretch-press forming of stainless-steel sheets can be done without work hardening if the sheet is sufficiently chilled before forming. The Convair Div., General Dynamics Corp., cools the sheets with a combination of alcohol and dry ice. The sheet is removed from the bath with a temperature of about –60 F and transferred directly to the press.

Frequently, aluminum alloys are formed in the SO state and then heat treated. This leads to warpage and distortion and necessitates a restrike or hand straightening operation. If the parts are stored at –10 F immediately after heat treating and are kept at this temperature until time for the restrike, age hardening is prevented.

Aluminum parts in the SW condition were held under refrigeration by Douglas Aircraft Co., Inc., but they work-hardened prematurely during pressure forming. This resulted in high breakage. An investigation of the problem showed that part of the trouble was the time required for the parts to reach the holding temperature in the freezer. A quenching procedure was developed that would quickly take the part below 0 F. The first difficulty was to find a fluid that would remain liquid at the desired temperature. The solution used is a combination of Stoddard solvent and trichlorethylene with dry ice as the coolant, *Fig.* 9. Production tests showed this to be a good answer to the problem and breakage during stretching dropped quickly to zero. Under normal conditions, breakage had been about 50 percent.

An entirely different type of hardening is prevented by reduced temperatures. Aircraft companies use a lot of plastic sealants and potting compounds that start to harden as soon as the catalyst and resin are mixed. Republic Aviation Corp., refrigerates polysulfide (synthetic rubber) sealants at –20 F

after the hardening agent has been added. This inhibits hardening until the material is positioned around canopies and similar areas.

Because the thiokol rubber potting materials used at Convair-Pomona have a short work life, they tended to set before getting to the molds. This material is adhesive and it stuck tenaciously to the barrel of the gun, presenting a cleaning problem. Now, the material is poured into 1-lb throw-away polyethylene cartridges and stored at –28 F for as long as three months. Cartridges are taken from storage and placed in the gun just before use so that gun cleaning is not a problem. Cartridges are color coded to indicate the time of filling.

Rubber-based sealants are handled slightly differently by Douglas Aircraft. Materials are mixed and poured into polystyrene tubes. The tubes are quick-frozen at –100 F and are stored at –40 F. They are transported to the points of use in a portable refrigerated cabinet mounted on an electric truck.

Miscellaneous Uses of Cold

When pouring castings in permanent molds, the metal must be free of hydrogen gas for best results. Hydrogen is found in the metal because of the moisture content of the blast air fed into the cupola. Scrap losses are highest in the summer, because of higher relative humidity, and can run as high as 15 percent. By conditioning the air to 40 F, summer scrap losses are held to 7 percent.

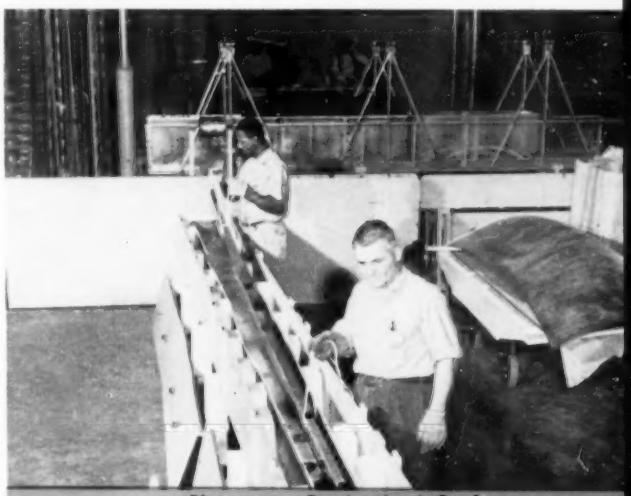
General air conditioning has its place in production too. Wherever comfort, cleanliness, controlled humidity, precision and product quality are important, air conditioning should be considered. More and more plants are being designed so they can be completely air conditioned.

Temperatures as low as –150 F are now being used to dehydrate process gases. The gas is piped through copper coils immersed in a convection fluid in the chilling chamber of a mechanical refrigeration unit. At such low temperatures, all moisture condenses out of the gas.

This same principle is used by Philco Corp. to determine the amount of residual moisture in motor-compressor assemblies. The unit is installed in an oven and after a sufficiently high temperature is reached, the air is exhausted by a vacuum pump. Discharge is through a moisture trap placed in a bath at –100 F. The amount of condensate is an indication of the moisture content in the unit under test.

Glass, hermetic terminal assemblies are tested for leaks by subjecting them to five cycles of alternate immersion: five minutes in boiling water and five minutes in a mixture of dry ice and acetone (–85 F). After this shock treatment, they are tested for leaks with nitrogen gas at 350 psi pressure.

Various combinations of thermal treatments have been applied to spot-welded parts. Shear values of spot-welded assemblies are raised considerably by introducing a chilling step at –40 F. The best results have been obtained by chilling the parts, spot welding, chilling the assembly and artificially aging. Shear values have increased by as much as one-third.



—Photo courtesy Douglas Aircraft Co., Inc.

Fig. 9. Long parts can be given a subzero quench in specially designed troughs. Blocks of dry ice chill the Stoddard solvent and trichlorethylene mixture.

There isn't full agreement on the benefits to be derived from using reduced temperatures in production operations. Some uses are obviously beneficial; it couldn't be done any other way, but others are clouded in controversy. This article has taken the positive approach. If processes are not tried, it is definite that no benefits will be derived from them. Since some production engineers are obtaining good results with all the techniques described, there is no reason why they shouldn't be tried, and lots of reasons why they should.

Acknowledgment

In addition to the companies mentioned specifically in the text, the author acknowledges the contributions of THE TOOL ENGINEER Field Editors. They have done much to make this a complete article.

determining ECONOMIC LOT SIZE

By F. J. Langier
Warsaw, Poland

Large production lots lead to lower over-all production costs, since setup costs per piece are minimized. At the same time, storage costs may offset reduced production costs. Economic lot size may be defined as the number of pieces per run that will result in lowest piece cost, taking into account both setup and storage charges. Economic lot size for any type of part can be determined arithmetically, using the accompanying table.

MANY METHODS FOR DETERMINING economic lot sizes involve rather elaborate computations or the use of nomograms. It is possible, however, to determine economic lot size for any part or operation by using one formula:

$$n = \sqrt{\frac{200iK_o}{pk}}$$

where n is economic lot size (number of pieces), i is the annual consumption of parts (number of pieces), K_o is the setup cost per lot (dollars); p is the annual carrying charge (interest on investment, plus storage costs, expressed as a percentage of the value of the part); and k is the value of each piece (dollars).

To minimize computation, this formula has been used to develop TABLE 1. Given the annual consumption of parts, the annual carrying charge factor, the setup cost per lot and the value of each piece, economic lot size can be determined directly from

Table 1—Economic Lot Size

Carrying Charge (percent)				Annual Consumption* (pieces)									
10	12.5	16.0	20.0	100	160	250	400	630	1000	1600	2500	4000	6300
Ratio K_o/k				Economic Lot Size† (pieces)									
0.008	0.01	0.0125	0.016	4	5	6.3	8	10	12.5	16	20	25	31.5
0.0125	0.016	0.02	0.025	5	6.3	8	10	12.5	16	20	25	31.5	40
0.02	0.025	0.0315	0.04	6.3	8	10	12.5	16	20	25	31.5	40	50
0.0315	0.04	0.05	0.063	8	10	12.5	16	20	25	31.5	40	50	63
0.05	0.063	0.08	0.1	10	12.5	16	20	25	31.5	40	50	63	80
0.08	0.1	0.125	0.16	12.5	16	20	25	31.5	40	50	63	80	100
0.125	0.16	0.2	0.25	16	20	25	31.5	40	50	63	80	100	125
0.2	0.25	0.315	0.4	20	25	31.5	40	50	63	80	100	125	160
0.315	0.4	0.5	0.63	25	31.5	40	50	63	80	100	125	160	200
0.5	0.63	0.8	1	31.5	40	50	63	80	100	125	160	200	250
0.8	1	1.25	1.6	40	50	63	80	100	125	160	200	250	315
1.25	1.6	2	2.5	50	63	80	100	125	160	200	250	315	400
2	2.5	3.15	4	63	80	100	125	160	200	250	315	400	500
3.15	4	5	6.3	80	100	125	160	200	250	315	400	500	630
5	6.3	8	10	100	125	160	200	250	315	400	500	630	800
8	10	12.5	16	125	160	200	250	315	400	500	630	800	1000
12.5	16	20	25	160	200	250	315	400	500	630	800	1000	1250
20	25	31.5	40	200	250	315	400	500	630	800	1000	1250	1600
31.5	40	50	63	250	315	400	500	630	800	1000	1250	1600	2000
50	63	80	100	315	400	500	630	800	1000	1250	1600	2000	2500
80	100	125	160	400	500	630	800	1000	1250	1600	2000	2500	3150
125	160	200	250	500	630	800	1000	1250	1600	2000	2500	3150	4000
200	250	315	400	630	800	1000	1250	1600	2000	2500	3150	4000	5000
315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300
500	630	800	1000	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000
800	1000	1250	1600	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
1250	1600	2000	2500	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500
2000	2500	3150	4000	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
3150	4000	5000	6300	2500	3150	4000	5000	6300	8000	10000	12500	16000	20000

*If annual consumption is from 10,000 to 630,000, multiply this value by 100; if annual consumption is from 1 to 63, divide this value by 100.
†If annual consumption is from 10,000 to 630,000, multiply this value by 10; if annual consumption is from 1 to 63, divide this value by 10.

the table. The period between runs, that is, the length of time the "economic" lot will last before a new production run is necessary, is readily computed. Denoting this period as t,

$$t = n/i$$

Examples: Perhaps the best way to illustrate the use of the chart is by working out sample problems. Four examples are given, each illustrating a different situation. In EXAMPLE 1, for instance, setup cost is extremely low in comparison with the value of the part and annual consumption is also low. In EXAMPLE 4, setup cost is extremely high as compared to the value of the part, and annual consumption is high. The other examples range between these two extremes.

EXAMPLE 1: Setup cost is $16 and the value of each piece is $1,000; therefore, the ratio K_o/k is 0.016. Carrying charges are computed at 20 percent; annual consumption is 100 pieces. To find the economic lot size, read down the column for a 20 percent carrying charge to the value 0.016. Then read down the column indicating an annual consumption of 100 pieces, stopping at the line where the value 0.016 appears. The economic lot size is 4 pieces.

Nomenclature

LANGIER

i = annual consumption of parts, pieces
K_o = setup cost per lot, dollars
k = value of each piece, dollars
n = economic lot size, pieces
p = annual carrying charge, percent, i.e., interest on investment plus storage charges, expressed as a percentage of part value

VARNUM

c = value of each piece, dollars
k = annual carrying charge per dollar of inventory, dollars
L = lot size, pieces
m = monthly consumption, pieces
P = lot production time, month
S = setup cost per lot, dollars
T = constant travel time during lot production, month
v = ratio of machining time to lot size, months per piece

Table 2—Approximate Values of $(1 + mv)$

Lot Machining Time Month	Hours		Period Between Lot Orders (months) 0.25	0.50	1.0	2.0	4.0	8.0
	One Shift	Two Shifts	Values of $(1 + mv)$					
0.125	25	50	1.50	1.25	1.12	1.06	1.03	1.015
0.25	50	100	2.00	1.50	1.25	1.12	1.06	1.03
0.50	100	200	3.00	2.00	1.50	1.25	1.12	1.06
1.00	200	400	5.00	3.00	2.00	1.50	1.25	1.12

EXAMPLE 2: Setup cost is $10 and the value of each piece is $12.50; therefore, K_o/k is 1.25. Carrying charges are 16 percent and the annual consumption is 25 pieces. The correct column for 25 pieces is found by dividing the values shown on the table by 100 (2500/100 = 25). Actual economic lot size is 20 pieces (200/10).

EXAMPLE 3: Setup cost is $20 and the value of each piece is $1; therefore, K_o/k is 20. Carrying charges are 16 percent and the annual consumption is 1000 pieces. Economic lot size, 500 pieces, is read directly from the table.

EXAMPLE 4: Setup cost is $50, value of each piece is $0.10; therefore, K_o/k is 500. Carrying charges are 16 percent and the annual consumption is 40,000 pieces. The correct column for 40,000 pieces is found by multiplying the values shown on the table by 100 (400 x 100 = 40,000). Actual economic lot size is 16,000 pieces (1600 x 10).

Varnum Formula: The formula on which TABLE 1 is based was first published by the author in *Polish Organization Review*, No. 2, 1931. A similar formula has been developed by E. C. Varnum.* In the Varnum formula:

$$L = \sqrt{\frac{24mS}{kc\ (1 + mv)}}$$

Different symbols are employed by Varnum: L is economic lot size; S is setup cost per lot, dollars; k is annual carrying charge per dollar of inventory; c is the value of each piece; m is monthly consumption in pieces; and v is the ratio of machining time to lot size in months per piece. This formula is identical to the one used in developing TABLE 1 except for the factor $(1 + mv)$, which takes into account the interest on capital during lot production time. In developing a nomogram for economic lot size, Varnum includes an average value for $(1 + mv)$ in the factor k. Varnum does not state what average value for $(1 + mv)$ was used; however, a formula for finding $(1 + mv)$ can be derived as follows:

Where P is lot production time per month and T is constant travel time during lot production per month,

$$v = \frac{P - T}{L}$$

$$mv = \frac{P - T}{L/m}$$

$$1 + mv = 1 + \frac{P - T}{L/m}$$

Approximate values for $(1 + mv)$ are shown in TABLE 2. It will be noted that this factor has negligible influence on economic lot size if the period between lot orders is as great as one month and the lot machining time is relatively short.

*See "How to Pick the Economic Lot Size," THE TOOL ENGINEER, November, 1956, pp. 85-88.

Less Data Might Help Business Management

EFFECTIVE operation of business in today's automated economy is dependent on less but more usable facts on daily function. Further, management's mania for facts and statistics is miring it in a "labryinth of irrelevant detail," according to Walter W. Finke, president of Datamatic division of Minneapolis-Honeywell Regulator Co., speaking to the American Management Assn. conference. As an alternative, better organized, more comprehensive, pertinent data would simplify decision making when coping with already complicated problems.

Daily operations, he feels, can better be dealt with scientifically by taking advantage of modern electronic computing "tools".

Forming Stainless Steel

FORMING is one of the major shop operations at most plants where stainless steel parts and products are fabricated. Among the principal stainless steel forming operations are brake bending, drawing and stamping, spinning, stretch forming and tube forming. The stainless steels, like other metals, have specific characteristics that affect formability. If these characteristics are taken into account, no difficulty will be experienced in forming operations. The compositions of several types of stainless steel often used for forming are shown in TABLE 1.

Brake Bending: Press brakes make straight-line bends with radii that are controlled by the tools employed. The length of bend depends on the width of the brake. Chromium-nickel stainless steels in the annealed condition can be bent to sharp radii if necessary. Parts with radii equal to metal thickness can be readily formed.

Table 1—Compositions of Several Types of Stainless Steels (percent)

Element	Type 302	Type 430
Chromium	17-18	14-18
Nickel	8-10	
Carbon	0.15 max	0.12 max
Manganese	2 max	1 max
Silicon	1 max	1 max
Phosphorus	0.045 max	0.04 max
Sulfur	0.03 max	0.03 max

Data furnished by The Committee of Stainless Steel Producers, American Iron and Steel Institute. Other characteristics of stainless steel are covered in the booklet *Stainless Steel in Product Design*, available from the Committee, 150 East 42nd St., New York 17, N. Y. Application data is included.

Type 430 stainless steel can also be brake formed but somewhat larger radii are advisable. The recommended inner radius ranges from one to two or three times metal thickness, depending on thickness of stock, angle of bend, finish requirements, and orientation of bend with respect to the original rolling direction of the metal.

When bends are sharp, the material along the outside edge may have an open or roughened texture, especially if the axis of the bend parallels the rolling direction. This roughness can be eliminated by polishing, by using a larger radius, by preheating the metal or by arranging for proper orientation of the metal relative to the rolling direction. As a general rule, when stock thickness is 0.032 inch or less it is best to allow a radius of one metal thickness. For greater stock thicknesses, radii should be two or three times the metal thickness.

Drawing and Stamping: Stainless steel drawing and stamping operations are much the same as similar operations on other metals. The behavior of Type 430 stainless steel, for instance, is somewhat the same as that of mild steel, although Type 430 is stronger and requires heavier die forces. The 18-8 stainless steels can be readily stretched and deformed. Like copper and brass, these materials work harden during stretching. Annealing between operations is sometimes required when forming is severe. The similarity of these steels to copper and brass is useful when planning forming operations but shop equipment for working stainless must be considerably more powerful than that used for copper and brass.

In stamping dimples, cups, cones, or flared holes, metal flows inward from all directions. A cup that

might be drawn easily from a small blank, *Fig.* 1, cannot be formed when it is in the middle of a large blank. The material in the blank restrains the metal from drawing inward, causing local stretching and tearing. When dimpling or flaring holes, burrs or nicks around the edges of a hole must be removed to minimize tearing.

In stainless steel shrink forming operations, wrinkling can occur at corners and flanges where the metal is shortened along one dimension. Stainless steel, especially in the 18-8 grades, can be stretched, but shrinking is more difficult. Notches, cutouts and narrow flanges, *Fig.* 2, can be employed to overcome wrinkling. The tendency toward wrinkling can also be overcome by use of multiple dies, hydraulic cushions and similar means. Elaborate equipment, however, may be costly, raising manufacturing costs accordingly.

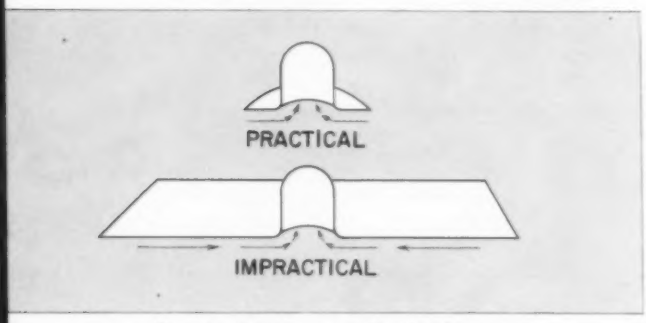


Fig. 1. Drawing small dimples, cups, cones or flared holes in large sheets may cause the metal to stretch and tear locally.

The depth of cup that can be formed in a single draw with Type 430 stainless steel is about one-fourth of cup diameter, *Fig.* 3. With Type 302, maximum depth is about three-fourths of cup diameter. Percentage reduction, R, can be expressed:

$$R = 100\ \frac{D}{D-d}$$

where D is blank diameter and d is cup diameter. Maximum reduction is approximately 30 percent for Type 430 and 50 percent for Type 302.

Minimum radii of 4 to 16 times metal thickness at the base of a cup and at the base of a flange will help prevent difficulties. When the part is box-shaped, rather than round, ample corner radii in the plan view, say 10 percent of box width, facilitate forming.

Spinning: When sheet stainless parts are symmetrical about an axis of rotation, they can be spun on a lathe. Spinning has gained a reputation for economy on short runs or one-of-a-kind jobs because the mandrel or form over which the metal is worked can be wood. Tooling is thus considerably cheaper than press tooling. Stainless parts are also spin-formed in substantial production lots and the process meets some kinds of design requirements better than any alternative method.

Generally, the closer a blank resembles a part, the easier the spinning job will be. Rolled-up and

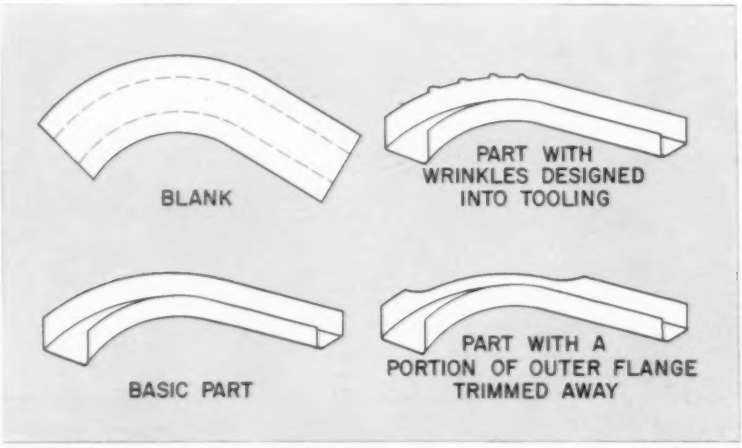


Fig. 2. Formed channel is typical of shapes that may give troubles from wrinkling. Designed-in winkles or notches, upper right, make it less difficult to form deep flanges. Another solution is to design a part with a portion of the outer flange trimmed away, lower right.

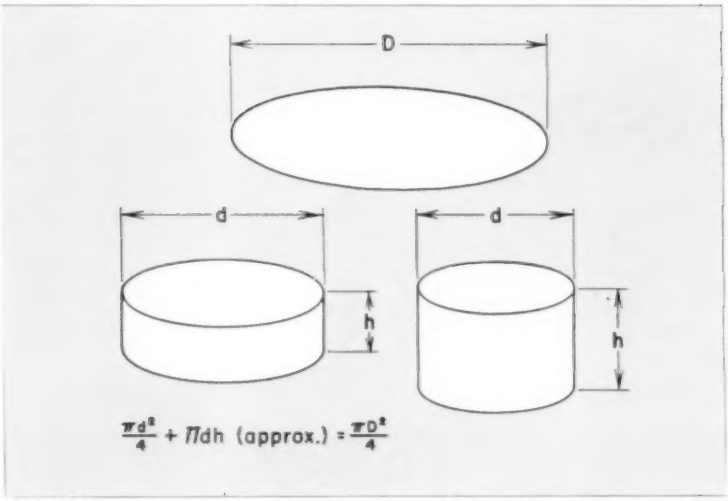


Fig. 3. Typical drawn cup shapes. Severe draws require progressive dies or other special tooling.

welded cones, cylinders or bands may be used for blanks, as well as flat disks. Commercial thin-wall stainless tubing, which is available in diameters up to 36 inches, may be cut into lengths for spinning blanks.

The cost of spun parts will be lower if ample tolerances, in the order of ±0.016 inch, can be accepted. Generous radii also help to keep costs in line. A good minimum radius is five times blank thickness. Parts with undercuts require mandrels that can be taken apart to remove the part after forming.

Blank finishes are usually destroyed during spinning. The parts are usually refinished as a final operation on the spinning lathe.

Tube Forming: Tube forming covers both bending tubular pieces and swaging or upsetting them to change their diameters or thickness in certain portions. Bending costs can be kept in line if bending radii are large enough so that the piece can be formed with simple tooling. The data in TABLE 2 will serve as a guide in determining if bending radii are adequate.

Bending is also facilitated if each individual bend is made continuous and with a constant radius. All bending should be in one plane. Bent portions of the tubing should be separated by several diameters if possible.

Table 2—Suggested Minimum Bend Radii for Stainless Tubing

OD of Tube (inch)	Wall Thickness (inch)					
	0.031	0.037	0.050	0.062	0.078	0.109
	Bend Radii (inch)*					
⅜	1¼	1⅛	..	..	..	..
½	..	1½	1⅛	1¼	..	..
¾	..	2¼	2¼	2	2	..
1	..	..	3	3	2¾	2¾
1½	..	..	4¼	4½	4¼	4¼
2	..	..	6½	6	6	6
3	..	..	..	9	9	9

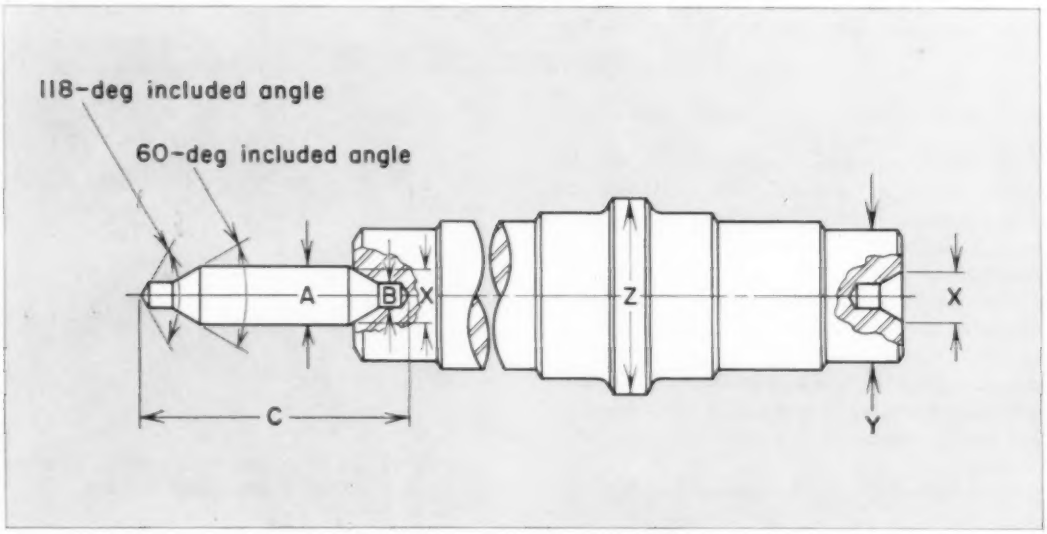
*These radii are for 90-deg machine bends without a mandrel inside the tube. Sharper bends can be made with a mandrel. Larger radii are recommended for 180-deg bends and still larger radii for continuous coiling.

Center Drill Selection

By George David Pheil
Racine, Wis.

SELECTION of combination center drill sizes is often left to the discretion of machine operators. The accompanying chart, when posted by the machine, will help to eliminate haphazard selection of drills. One or more charts should also be available to draftsmen so that the center-drilling operation will be included on part drawings.

Individual machine shops may wish to modify the chart to suit their specific requirements. The sizes listed, however, cover a wide range and will prove adequate for most shops.



Center Drill Selection Chart

	Center Drill Sizes (inches)			Workpiece Diameter (inches)		
No.	Body Diam (A)	Drill Diam (B)	Length (C)	Diam in Shaft (X)	Pilot Diam (Y)	Largest Diam (Z)
1	1/8	3/64	1 1/4	0.11	3/16	—
2	3/16	5/64	1 1/2	0.15	1/4	—
3	1/4	7/64	2	0.20	5/16	—
4	5/16	1/8	2 1/2	0.25	13/32	—
5	7/16	3/16	2 3/4	0.40	1/2 to 5/8	—
6	1/2	7/32	3	0.44	11/16 to 1	—
7	5/8	1/4	3 1/4	0.50	—	2 1/2 to 3 1/4
8	3/4	5/16	3 1/2	0.56	—	over 3 1/4

FEATURED IN FEBRUARY

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NEWS

Unconventional Speaker Chosen for Convention

An eloquent and uninhibited champion of production efficiency—doing things the easy way, that is—will monopolize the conversation at what promises to be the most un-technical session in the annals of the American Society of Tool Engineers.

William Hazlett Upson, who likes to tell overeaters how they can break their bad habit without using any will power, has been chosen by the national program committee to address the 26th Annual Meeting banquet in Philadelphia. The fete begins at 7:30 p.m., Wednesday, May 7, in the grand ballroom of the Sheraton Hotel.

Writer, wit, successful goldbrick, erstwhile tractor trouble shooter and perennial favorite of lecture-hall audiences, Mr. Upson has chosen as his chief topic "Ergophobia," or morbid fear of work. As a gesture to his tool engineer hosts, he will expand on his widely broached theme that useless toil is wasted energy. By virtue of his long-standing addiction to ergophobia, and of his lifelong search for the perfect job (good salary, no work), he is eminently qualified to speak on this subject of the economics of laziness.

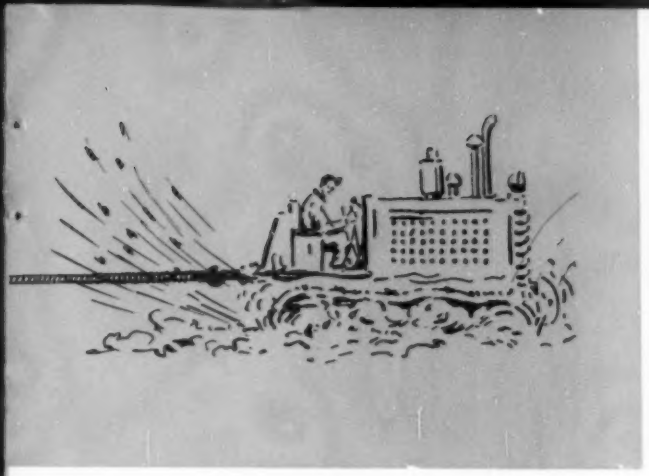
William Hazlett Upson

The choice of Mr. Upson is quite out of line, incidentally, with the theme of the ASTE's big 1958 show, "Tooling for Competition." Bill Upson laid down his last tool in 1924, he will have you know; and as for "Competition," he lets his fictional alter ego, Alexander Botts of the Earthworm Tractor Company, handle that unpleasant angle of the business.

More than a hundred of Mr. Upson's stories, most of them about that fabulous salesman A. Botts, have appeared over the past three decades in the *Saturday Evening Post*. Even Mr. Upson will concede that Botts could not have retained his terrific self-assurance had not those design and tool engineers back in Earthworm, Illinois, kept turning out a product he could "push" with confidence.

Both Botts and his creator have kept up with the times. In his most recent adventure, Botts stood on the threshold of automation, of sorts. The firm's engineering brains furnished the brawn for a stupendous field demonstration of automated bulldozing: four of the big XX88 Earthworm tractors, assembled side by side into a heavy, jointed-steel frame and equipped with tree pushers, rooters, shredders, rock crushers and giant subsoil plows, proved they could level the Florida swamps as fast as real estate men could sell them.

Born a New York City suburbanite, young Upson quickly decided his father's life as a Wall Street lawyer was too strenuous for him, and decided to become a farmer where he could boss himself and be, in his words, "quiet, languid, and blissfully happy." He spent four years pursuing his dream at Cornell University agricultural school. Then came three years of actual farming—three years of such hard work that Mr. Upson to this day shudders when he thinks about it. In 1917 he escaped by enlisting as an Army private. He served in the major World War I offensives, and was with the Army of



Occupation in Germany. The war, he says, was one of his "most fatiguing" experiences.

In 1919 Mr. Upson joined the Service Department of the Caterpillar Tractor Company of Peoria, Illinois. His job was traveling around the country after the salesmen, trying to make the tractors do what the salesmen had said they would. He repaired the machines and instructed the operators—and gathered material to finance a future of loafing.

His tractor career was interrupted in 1924 by illness. During convalescence, he wrote some short stories which, to his amazement, were bought by magazine editors. Since then he has devoted himself to writing and lecturing; to his wife, son, and daughter; and to his adopted home town, Middlebury, Vermont.

ASTE members and their wives who attend the banquet are assured, by Mr. Upson's presence, of plenty of dessert—and an antacid, too.

ASTE to Honor 7 at Philadelphia

Six national honor awards and the Eli Whitney Memorial lecture are on the special laurels agenda during the ASTE's May 1-3 Convention in Philadelphia.

The citations for oustanding achievement in tool and manufacturing engineering will be given out at the honor awards dinner on May 5. They are:

Education—for developing dynamic curricula and sound training methods, or inspiring students to enter on tool engineering careers.

Research—for significant published research on materials, facilities, principles, and operations, and their application.

Progress—for accomplishments in manufacturing processes, methods, or management.

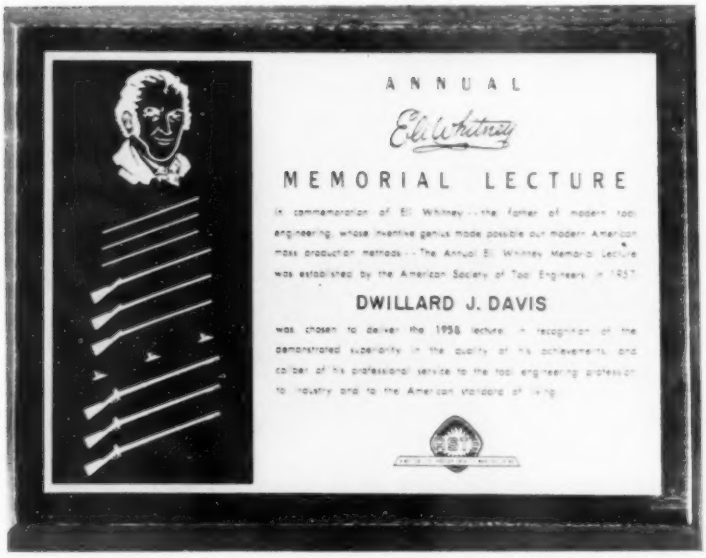
Gold Medal—for outstanding service through published writings or papers dealing with tool engineering.

Joseph A. Siegel Memorial—for contributions through leadership, voluntary support, or other acts of benefit to the Society; perpetuated by past presidents in memory of the ASTE's charter president.

Engineering—honoring unusual skill by an ASTE member in the development of tool engineering principles.

Both ASTE members and nonmembers are eligible for all except the Siegel Memorial and Engineering awards, which are restricted to members. Selections are made by the national honor awards committee, composed of nine ASTE past presidents.

A Detroiter, Dwillard J. Davis, Ford Motor vice president of manufacturing, will deliver the Eli Whitney Memorial lecture at a May 6 luncheon. Mr. Davis will speak on "Planning for Profit." He was chosen as the man who best emulates Whitney, founder of modern tool engineering and pioneer of U. S. mass production.



Philadelphia host committee

EDWARD H. WHEELER
General Chairman

C. R. PITTSINGER
Vice Chairman

RICHARD D. GROSS
Secretary

Twenty-five Philadelphians have been designated to fill host chapter committee duties for ASTE's 1958 Convention.

In addition to those pictured here, John F. Trainor and Harry J. Leuders will act as plant tour chairmen; Allen B. Taylor, Jr. will be reception chairman; William T. Robers and Howard W. Gross will host the Philadelphia Day luncheon; and Thomas J. Donovan will help with Atlantic City Day activities.

Cooperating chapters are Pittsburgh, Baltimore, Northern New Jersey, Central Pennsylvania, Greater New York, Williamsport, Lehigh Valley, Greater Lancaster, Keystone, Paterson, Monmouth, Schuylkill Valley, and Trenton-Delaware Valley.

WALTER L. DeMARIS
Technical Sessions

WILLIAM MOORE
Division "A" Coordinator

ROBERT E. WENDIG
Division "A" Coordinator

LEONARD HOROFF
Tickets Chairman

FRANK McCARTHY
Transportation Chairman

MRS. ROBT. GRIFFITH
Ladies Activities

MRS. PAUL RAGUSE
Ladies Activities

MRS. WM. GRIFFITH
Ladies Activities

HARLAND O. FULLAM
Division "B" Coordinator

C. C. BROGAN, JR.
Division "B" Coordinator

ROBERT SCHWING
Sessions Arrangements

CHARLES GREWAY
Signs Chairman

ALBERT C. STRAUB
Emergency Chairman

ERIK A. LUND
Division "C" Coordinator

WILLIAM DIETRICH
Records and Reports

HARRY D. WOOD
Publicity Chairman

ED HOLLINGSWORTH
Atlantic City Day

EMPHASIS ON ADVANCED

...practice courses start in Houston, New York, Chicago

Emphasis was on "ADVANCED" as the third in the series of ASTE Advanced Tool Engineering Practice courses got underway at Houston January 15 and as plans for a fourth series at Chicago, beginning February 4, neared completion.

Lecturers were hand-picked and subjects were tailored to area industries for the fifteen-session programs by the chapter executive committees in Houston and Chicago, working in cooperation with the ASTE national education committee.

Format for the courses—two-hour sessions, split between lecture and discussion period—stemmed from the successful pilot series in advanced tool engineering practices held in 1957 in Jackson, Mich., and in Buffalo. But the content of the courses is still experimental, National Education Director Gilbert E. Seeley points out, and the aim in future series planning is quality rather than quantity.

"Subject matter must be really new in each one of these projects, in order to fulfill the purpose of the program—bringing busy tool engineers up to date on advanced techniques," Mr. Seeley said.

As indication of this emphasis on originality of content, Mr. Seeley noted that only two of the Houston series lectures were repeats from last year's programs. And there are no duplications on the Chicago agenda.

Designed for Experienced Engineers

Specially designed for process and production engineers and factory management personnel who have at least five years' experience in tool engineering, the advanced practice series are restricted in enrollment to assure maximum individual participation. Fees are $50 for Society members and $75 for nonmembers, and certificates of achievement will be given those who satisfactorily complete the courses.

Among early lecturers on the Houston program were James Sutherland, foundry equipment engineer with the Link-Belt Company, speaking on "Shell-Molded Castings in Manufacturing"; James W. Dopp of LaPointe Machine Tool, on "Application of Broaching in Production"; and Ralph Moschella, manager of sonic product research at Raytheon Corporation, discussing "Principles and Application of Ultrasonic Machining."

Coordinator for the Houston series is Chris A. Vogt. The weekly meetings, extending through April 23, are being held at the main office auditorium of the Hughes Tool Company in Houston.

Chicago coordinator is Roy Perkins, associate professor of engineering at the University of Illinois Extension Division, Navy Pier, Chicago. The series there extends from February 4 through May 13.

Advanced Course at New York

Still another educational series, sponsored by the Greater New York chapter, was planned for a February 7 start.

Entitled "Advanced Tooling and Production Techniques," the course is procedurally similar to the Advanced Tool Engineering Practice Series and shares that program's goals.

Coordinator is Louis Wertman, Greater New York education committee chairman.

Subjects to be covered include ceramic tooling heat treating, broaching, crush wheel grinding, precision casting, injection molding, tape-controlled milling, machining stainless steels, and welding.

1958 ASTE Scholarships Total $12,000 Technical Institutes Now Eligible

College students in their third or fourth year of studies in mechanical, industrial or tool engineering, and senior students planning to do graduate work in those areas will once again compete for the ten ASTE International Education Awards, totaling $7000, to be presented during the 1958-59 school year. In addition, the scholarship program, now in its seventh year, has been extended by recent ASTE Board action to include students in junior colleges and technical institutes having two-year terminal programs.

In the latter category, twelve first-year students will receive $400 each toward continuation of studies in their second year in such phases of tool engineering as metal processing, plant layout, tool design and development, inspection and quality control, and manufacturing processes.

A March 1 deadline has been set for scholarship applications, which are procurable now from ASTE headquarters, 10700 Puritan Ave., Detroit, and from local ASTE chapters. Major criteria for selection of winners will be a sincere interest in pursuing tool or manufacturing engineering as a career, a creditable record of scholastic achievement to date, plus the recommendations of a screening committee, composed of faculty members and the local ASTE chapter's education committee.

officers meet at headquarters

National officers of the ASTE gathered at the Detroit headquarters of the Society on January 4 for week-end talks aimed toward implementing and clarifying decisions made at the semiannual meeting in Milwaukee, October 31-November 1 last year.

Central in their discussions were various phases of the upcoming Philadelphia Convention and particularly the leadership conference, which is being revived as an annual feature of the Convention.

The officers scheduled their next meeting for March 28-30, at headquarters. At that time they will review the annual report and will visit the ASTE's property near Ann Arbor.

All national officers were present at the Detroit meeting: Harold E. Collins, president; George A. Goodwin, Wayne Ewing, H. Dale Long, and William Moreland, vice presidents; John X. Ryneska, treasurer; David A. Schrom, secretary; and Harry E. Conrad, executive secretary, and Allan Ray Putnam, assistant executive secretary. Also present was H. C. McMillen, immediate past president.

From the meeting Mr. Collins headed directly for Europe, on a five-week business trip in Ireland, England, Germany, and Switzerland.

Ceramic Tool Seminars

Ceramic Tool Seminar Chairman Myron D. Gabbert, of the Chicago chapter, holds the floor at the technical session, flanked by the morning's speakers.

CERAMIC tools, their physical properties and their practical applications, were brought home to the production leadership in the Chicago and Cleveland areas at ASTE-sponsored seminars held December 12 and January 24, respectively, in those cities.

Patterned after the original symposium at the Society's Annual Meeting in Houston last year, the one-day Ceramic Tool Seminar in its regional version consists of technical sessions capped by a two-hour, open-forum panel discussion. This "working" session, in which two skilled moderators guide the give-and-take between the panel of experts and the audience, is designed to help participants find out how best to institute a sound ceramics program in their own production setups.

The seminar series, the first sponsored by the ASTE on a single subject on a registration fee basis, is under the guidance of National Education Director Gilbert E. Seeley. The first regional presentation of the ceramics program was at St. Louis last summer, and other bookings are envisioned to follow

Ceramic tool talk continued during break at the Chicago seminar. Here R. L. Witsche (far right), chairman of the afternoon program, chats with (left to right) Myron D. Gabbert; Harry E. Egan, Chicago chapter chairman; Emil E. Sobilo, Calumet Area; and David S. Lambie, Calumet chapter chairman.

at Chicago, Cleveland

the ceramics seminars at Chicago and Cleveland.

Chairman of the morning session at Chicago was Myron D. Gabbert, of the local chapter. R. L. Witsche, assistant general supervisor of mechanical engineering in International Harvester's Research Division, chairmanned the afternoon session. Scene of the meeting was the Morrison Hotel.

Carl J. Leska, chairman of the Cleveland ASTE chapter, had charge of sessions of the seminar there, at the Carter Hotel.

Speakers at Chicago were W. E. Engle, Vascoloy-Ramet Corporation; G. W. Barnes, the Norton Company; Professor H. D. Moore, industrial engineering department of Ohio State University; J. Roubik, Kearney & Trecker Corporation; Robert T. Hook, The Warner & Swasey Company; and W. S. Humphreys, American Lava Corporation.

On the panel were E. J. Weller, General Electric; E. J. Krabacher, The Cincinnati Milling Machine Company; W. B. Kennedy, Watertown Arsenal; and E. Kibbitt, Stupakoff Division of The Carborundum Company.

Deep in discussion during the Ceramic Tool Seminar at Chicago are (left to right) Robert A. Wason, editorial director of Denham & Co., Detroit; ASTE Education Director Gilbert E. Seeley; and Ben Brosheer, associate editor of the *American Machinist* magazine. Mr. Wason and Mr. Brosheer were moderators of open-forum session.

C. M. Franz points to ceramics exhibit, while fellow ASTE members John Stalter and C. W. Hottinger look on.

"Organization of the San Francisco Chapter of the American Society of Tool Engineers will provide a basis upon which the tool engineers can exchange ideas for the welfare of our community. It has long been recognized that Western industry has been handicapped in its competition with Eastern industry due to the differential of freight rates that affect basic raw materials and shipment of finished product.

"It is through the ingenuity of the tool engineer that Western industry has been able to remain versatile; to reduce its manufacturing cost to a degree not only to compete with the East but to produce defense material more economically." These words are part of the salution to the fledgeling chapter, made by Col. John M. Stark, key speaker at chartering ceremonies. They appear in the first issue of the chapter bulletin, The San Francisco Journal, whose cover motif, the typical old cable car, appears above.

In San Francisco . . .

The birth of an ASTE chapter in many ways parallels the birth of a child. The germ of an idea sparking the formation of a new Society starts a chain reaction, marked by intensive planning and organizing, and accompanied by mounting enthusiasm and anticipation. Climaxing the weeks and months of preparation, the chartering night ceremony transforms the embryo group into a self-sustaining entity, a functioning ASTE chapter encompassing all the aims and deriving all the benefits associated with the Society.

Conception of a long-range plan to form a San Francisco chapter of ASTE occurred when members of the large and active Golden Gate chapter realized that continued growth in the Bay Area made the formation of a new chapter not only a possibility but almost a necessity.

The night of August 27 saw a handful of men from the Golden Gate group, two of whom were also national committeemen, put the long-range plan into action. Two prospective members with applications already on file were also present.

Arriving to give a send-off to new chapter are ASTE officials from other California units. Top to bottom are: Bob Edgecomb, San Fernando; Stewardess Wanda Greer; Ben Hazewinkel, Los Angeles; Charles McNealy, Long Beach; Ed Cutler, San Gabriel; Kenny Nelson, Long Beach; John Walti, Centinela Valley; John Stansbury and Ray Gariss, Long Beach; Paul Lenk, Los Angeles; Jim Medford, Long Beach; Jim Rust, Santa Ana; Charles Ward, Long Beach; Phil Christoffersen, Riverside; Dean Rouland and Phil Freeman, Golden Gate.

ASTE President Harold E. Collins discusses procedures with Acting Chairman Wilbur Russell on eve of chapter chartering. Two hundred people attended.

a chapter is born

To form a working core of the new chapter's executive group, pro tem officers were elected: Wilbur Russell was the chosen chairman of the group, to be assisted by Frank Sweet as first vice chairman, Gilbert Hutchesen as secretary-treasurer, and Jack Corey as the all-important membership chairman. Jim Brennan, Golden Gate's first vice chairman, was assigned the task of organizing the new ASTE unit, his selection being based on outstanding past performances in this area of endeavor. Other Golden Gaters gave full support.

Wilbur Russell (right) is being pinned down for the permanent job as chairman of the new San Francisco chapter by former National Director Ben Hazewinkel.

Between the initial meeting in August and chartering on December 12, three organizational meetings were held, their programs patterned after those of a regular chapter meeting, replete with representatives from the national organization, technical speakers, and a very functional officer group.

Sample Meetings Attended by Enthusiasm

The first such meeting on September 19 drew 41 enthusiastic tool engineers, some of whom volunteered their services to the embryo chapter, and were immediately named to posts on the acting executive committee. National Director Ben Berlien "doubled in brass," as he so often does, by first discussing the activities and objectives of ASTE from the national vewpoint, and later delivering an enlightening lecture on the heat treating of metals.

At the second meeting, held October 24, and attended by national committeemen James Coulter and Dave Gustafson, the name San Francisco was

At chartering were (left to right) John Stansburg, Long Beach; Joe Cook, Santa Clara; President Collins; Ralph Chrissie, Los Angeles; Phil Freeman, Golden Gate; Jim Medford and Ray Gariss, Long Beach; Mike Flynn, San Francisco; Howard W. Holt, Santa Clara; and (foreground) Al Rando, San Fernando. Mr. Freeman is making use of the autograph space in first chapter bulletin.

officially adopted. An instructive film on obsolescence was the technical feature and, as always, an aggregation from Golden Gate swelled the attendance, this time to a total of 71. A third meeting in November featured Speaker Richard Melville, head of computer development for the Stanford Research Institute.

Skeleton Crew at Helm

During this period the acting executive committee met frequently to cope with problems as they arose. The secretary-treasurer worked with deficit financing as adroitly as does our government, eventually balancing the budget. Membership Chairman Corey accepted his goal of 75 new members (exclusive of transfers) and bettered it by 25 before chartering. Mike Flynn and his bulletin committee whipped the first copy of the San Francisco Journal into shape for its initial distribution at the ceremonies. Heading and coordinating these and countless other projects was Acting Chairman Wilbur Russell.

On December 12, some two hundred people gathered at the Oympic Club to celebrate San Francisco's coming of age. President Harold E. Collins arrived by plane, fresh from the chartering of Rochester Institute's student chapter the night before, to install San Francisco's officers and present them with the charter. All the pro tem officers were re-elected on a permanent basis, with Ross Christman taking over the treasurer's duties previously performed by the secretary-treasurer, Gilbert Hutcheson. Ben Berlien served as toastmaster, and Art Lewis, former director and founder of the San Fernando Valley chapter, presented the "baby bottle" to the neophyte organization.

Key speaker was Col. John M. Stark, commanding officer of San Francisco Ordnance District, who spoke on the importance of tool engineering in this day of complex missiles, new materials and automation developments.

Acting officers of San Francisco chapter line up with well-wishers from Golden Gate. Left to right are James V. Coulter, Golden Gate, national membership committee; Gill Hutcheson, secretary-treasurer; Wilbur Russell, chairman; Jack Corey, membership; Frank Sweet, first vice president; David A. Gustafson, Golden Gate, national editorial committee; and Phil Freeman, Golden Gate.

Charter officers of the new 92-member student chapter at Rochester Institute of Technology receive the oath of office from Society President Harold E. Collins, while Rochester Chapter Chairman Sears, Rochester Institute's President Ellingson, Russel McCarthy of the Chamber of Commerce, and Dr. A. V. Payne, president of Mohawk Valley Tech look on. Ready to assume their command are student officers (from left): Richard Osburn, chairman; Edward Wojtowicz, second vice chairman; Robert Miller, first vice chairman; Charles Eiswerth, treasurer; and Richard Mykins, secretary.

Tomorrow's Tool Engineers

Rochester Tech becomes 18th student chapter

At a dinner on Dec. 11, hosted by the senior Rochester chapter of ASTE, the student chapter at Rochester Institute of Technology received its charter to become the eighteenth such group in existence. National President Harold E. Collins did the chartering honors, citing Sherman Hagberg, Rochester education chairman and faculty member at R.I.T., and other chapter members and school instructors for their efforts, which culminated in the evening's event.

Mark Ellingson, president of the Institute, filled the key speaker slot, listing the challenges this age of specialization poses to the tool engineer who must continually provide better methods of production.

Special guests present to give the student group a good send-off, coupled with a bit of advice, were Albert V. Payne, president of Mohawk Valley Technical Institute; Russel McCarthy of the Rochester Chamber of Commerce; Marvin Bunting, staff administrator for membership, national headquarters; and Clifford Sears, chairman of Rochester chapter. More than thirty members of the senior Rochester chapter and 92 charter members of the student group attended the ceremony.

James Horne, a past director of ASTE, presents the chairman's pin to Richard Osburn.

Discussing the chartering agenda are Ford Sears, Rochester chairman, President Collins and Dr. Mark Ellingson, president of R.I.T.

UTAH
tool engineer grads find positions readily

Utah State's tool engineering curriculum is paying off in responsible jobs in industry for eight of the nine students graduating in that school in 1957. The ninth graduate is in naval officer training school.

Frederick Preator, head of the tool engineering department at USU and a member of the national education committee of ASTE, reports that the average starting salary for these '57 graduates was just under $500 a month, with the top student somewhat above that figure. Two of the graduates are engaged in compensated industry-training programs sponsored by the companies employing them.

The nine graduates, former members all of Utah State's student chapter, and their present employers are:

George Anderson, Caterpillar Tractor Company, Peoria, Illinois; Ross R. Bowman, Hewlett-Packard Company, Palo Alto, California; Roy Bjorkman, Rohr Aircraft, San Diego; Burnell Ellis, Jr., General Electric, Schenectady, New York; and John Cox, Minneapolis Honeywell, Freeport, Illinois.

Others in the graduating class were Harvey John, Pratt and Whitney, Hartford, Connecticut; Lewis D. Myers, IBM, San Jose, California; Bud Mortenson, Navy Officer Training Corps. Robert Rhodes, Westinghouse Electric, Pittsburgh, Pennsylvania.

WENTWORTH

Wentworth's student chapter keeps a bulletin board filled with up-to-date notices and tool engineering material. The October *Tool Engineer* cover and some of the articles therein help make this display eye-catching. In addition, notices of meetings, dues, and a scholarship offered by the Boston chapter help keep students well-informed and on their toes.

ASTE
on the campus

Alfred State student chapter's November meeting brought a turnout of 54 members to hear W. J. Stolp of Eastman Kodak, Rochester. Mr. Stolp explained the fundamentals of optical gaging with the help of slides, and afterwards presented a movie showing the application of these fundamentals.

Forty members of the **Purdue** chapter were treated to top-notch technical fare when, on December 10, V. V. Donaldson of the American Locomotive Company, Latrobe, Pennsylvania, and C. M. Schrisman of GE's Carboloy Division shared the speaker spotlight. Mr. Donaldson, who brought with him his associates C. S. Middleton and R. H. Binkerd, spoke on the subject, "Leaded Steels and Their Effect on Machinability," followed by Mr. Christman on "The General Electric Machinability Computer."

After the two talks, both the computer and the machinability of leaded steels were demonstrated together, with the computer using the data for machining leaded steels. Closed circuit TV made the steel turning demonstration visible to all observers. Oxides and carbides were used on the steel for additional comparisons between leaded and unleaded steels.

Despite a meeting date falling the night before term exams at **Southern Technical Institute,** the student members of that chapter gave an enthusiastic welcome to ASTE's national director Frank Ford who visited there that night. Mr. Ford reports the meeting a success, with the principal speaker Mr. Rochelle of American Telephone and Telegraph presenting a talk and film on the laying of trans-oceanic telephone cable. Last year students in tool engineering curricula had the opportunity of winning $100 in prize money, offered by the Atlantic chapter for the best essay on "What Is a Tool Engineer."

CAL POLYTECH

California State Polytech's special guests at its recent installation banquet were Paul Lenk, Los Angeles chapter chairman, and Edwin Cutler, past chairman of San Gabriel Valley and national education committeeman. Los Angeles was the student group's sponsoring chapter. At the ensuing technical session, D. A. Trescott of Super-Cut Distributors presented "Diamond Mining in Africa."

More recently, Curtis Little, Raytheon Manufacturing, explained the theories and practical applications of ultrasonic machining.

California Polytech officers for the school year 1957-58 installed by George Adams (right) of the Los Angeles chapter, are from left: William W. Worden, treasurer; Sam Kitaguchi, secretary; Leroy Brown, second vice chairman; Fred Tarver, first vice chairman, Thayne D. Wildon, chairman.

PURDUE

Visiting Purdue's student chapter from ASTE's Detroit headquarters is Marvin Bunting, membership administrator (front center) who answered questions about what industry will expect of the graduating engineer of tomorrow. With him in front is Mel Miller, chairman, while the back row shows (from left) Richard Jankowski, vice chairman; O. D. Lascoe, faculty advisor and national education committeeman; Fred Bydash, secretary; Dave Cooper, treasurer; and John McMillen, membership chairman.

CANTON

Canton Ag and Tech student members follow the procedure of many other student groups and elect their officers in the fall. Here faculty advisors Richard Eno and John Henderson stand behind new officers elected at the fall meeting in October. The officers are (from left) Pat Spicci, secretary; Margie Gardener, freshman vice chairman; Robert Stewart, chairman; Ray Limoges, senior vice chairman; Gary Carpenter, treasurer.

In the national SPOTLIGHT

An Editor Looks at EUROPE'S TOOLS

A logical starting point for interchange of scientific information among the United States and its allies, with mutual understanding and survival as the goal, would be at the tool engineering level.

This suggestion was advanced by Editor John W. Greve of THE TOOL ENGINEER, in a speech recorded for radio stations WFMJ, Youngstown, Ohio, and WCAE, Pittsburgh. Mr. Greve, who recently returned from a tour of West European industries, occupied the "easy chair" guest speaker spot on "Engineering News Report" January 5.

Such a swap of technical know-how would not be so one-sided as many believe, Mr. Greve indicated.

"There are many misconceptions in this country about the European methods of manufacture. We give Europeans credit for their excellent craftsmanship but, when it comes to production with machines and the application of automation, we feel they are far behind us. This is no longer true . . .

"In many respects European viewpoints could advantageously be adopted by us."

As an example of free-trade tooling at its best, Mr. Greve cited the machine shop of the Philips Company in Eindhoven, Holland, which is widely regarded as the most modern in Europe. Its equipment breaks down international barriers for the sake of efficiency: its small precision machines are Swiss; milling machines come from America; medium and heavy machines are German.

Nine hundred exhibits at the machine tool show in Hannover, Germany, convinced the touring editor that Europeans do not have to take a back seat in production equipment. European tools are not underpowered and do not lack rigidity, he found.

He was impressed by the European worker's pride in his job; by the busy-boom atmosphere generally prevalent, and especially so in West Germany; and by the fact that varying output rates of old and new machines are taken philosophically and meshed into production schedules as ingeniously as possible.

Informed industrialists on the Continent feel that development of free trade is imperative for a strong Europe. Relaxation of tariff barriers and any pooling of technical information would pose competitive and industrial problems, Mr. Greve concedes. But he suggests that the long-range benefits of such cooperation would more than offset these problems.

Reminder on Income Tax: SOCIETY COSTS DEDUCTIBLE

As the time nears for filing income tax returns, members of the ASTE are reminded that expenses incurred in connection with Society activities are deductible.

The Internal Revenue Service has held that a taxpayer "who gives his services gratuitously to an association, contributions to which are deductible (as is the case with the ASTE), and who incurs unreimbursed traveling expenses, including the cost of meals and lodging, while away from home in connection with the affairs of the association and at its direction, may deduct such unreimbursed expenses in computing his net income."

Such deductions, however, are limited in that they are totaled with all such gifts made by the taxpayer—and the total of such gifts made in any one year may not exceed 20 percent of the donor's gross income for the year.

Awareness of this ruling may serve to reassure some Society members who shun service on ASTE committees because of personal expense, which they erroneously believe to be nondeductible.

"In recent years, the kind of engineering skills that set up production and make it tick have tended to get lost in the shuffle between the scientists at one extreme and labor at the other. But production takes more than the smock-wearing corps and the overall-wearing team.

"Management, directors, and financial people alike will learn more about where our laboratory developments have taken us these last ten years, about where laboratory developments are about to take us in the next ten to twenty years, and about where production is headed and money is needed if they will take the time to perform a very simple chore. The more complex our economy becomes, the more useful this simple chore will prove to be. It is simply to read the definition of tool enginnering as published in Webster's Dictionary."—*Eliot Janeway.*

An Economist's View...

New YARDSTICK For Business

The automobile industry can no longer serve as the yardstick of the American economy, according to Eliot Janeway, economic adviser to numerous industries and head of the Janeway Publishing and Research Corporation.

Writing in the November-December 1957 issue of the *Harvard Business Review*, Dr. Janeway advanced the thesis that the bellwether of the U. S. economy today is the aeronautics industry and the related electronics, instrumentation, atomics, and missiles fields.

His article, entitled "Tooling Up for the Aeronautic Age," cited the unprecedentedly long lead times involved in the aeronautics investment cycle—approximately seven years, contrasted to the three-year automotive cycle and the few months' cycle of the trend-making textile industry a century ago—as the key to the over-all U. S. economy. In short, a defense cycle has replaced the business cycle.

The problem that has arisen under this new and dynamic system, Dr. Janeway wrote, is manpower for production—or, as he specified it, tool engineers. Industry will have to concentrate for a full decade on acquiring this production engineering personnel, and providing them the perquisites of status and security, in order to make its investment pay.

members in the NEWS

C. Dannehower

Don S. Connor

Dr. E. G. Loewen

M. M. Wiseman

Lloyd Lee

Robert A. Blum, Fort Wayne, has been named assistant to **Sergio E. Vige,** head of the recently formed Machine Tool Division of the Olivetti Corporation of America. Mr. Blum will assist in sales and service facilities of the new division at Long Island, New York.

David E. Armstrong, second vice chairman of Twin States chapter, and research engineer for The Fellows Gear Shaper Company, has recently become a Registered Professional Engineer.

Denzil Hawkins, Dayton, has recently been named vice president of The Producto Corporation. He will continue as branch manager of the company in Dayton.

Jack E. Davis, Milwaukee, has been appointed vice president in charge of operations at Seaman-Andwall Corporation, a division of American-Marietta Company. He was formerly assistant to the president.

George H. Waldeck, Philadelphia, has been appointed production manager of Airtronics International Corporation. Mr. Waldeck assisted in the development of the motor and jet engine for navy guided missile, Petrel, and in addition to his work on the J-44 engine at Fairchild, used by the Navy in the Q-2 target drone called the Firebee, he assisted in the design of compressors of gaseous diffusion processes in use today in the atomic energy plant near Oak Ridge, Tennessee.

Gilbert Dannehower, Northern New Jersey, was honored by the presentation of a doctorate of engineering at founders day exercises, October 26, at Lafayette College, Easton, Pennsylvania.

Micromatic Hone Corporation has announced the election of **Don S. Connor,** Detroit, as president and general manager. At the same time **Kirke W. Connor,** former president, was elected chairman of the board.

Walter Kudlaty, Chicago, has been promoted to chief design engineer for the Miller Fluid Power and Tru-Seal Divisions of the Flick-Reedy Corporation, Melrose Park, Illinois. He will be representative for product design and research.

Frank L. Brugger, Milwaukee, has been named product and sales manager of metal-cutting tools for Kennametal, Inc., Latrobe, Pa., effective January 1, 1958.

Daniel J. Kennedy, Buffalo-Niagara Frontier, currently factory manager for Buffalo Hydraulics Division, will move to Akron, New York, to become assistant general manager of the Wales-Strippit Company unit of Houdaille.

Adrian Cammelot, Chicago, has been appointed production manager of the Professional Equipment and Instrument Division of Bell and Howell.

Edward H. Roos, Denver, has been made vice president in charge of engineering, production and purchasing for the C. A. Norgren Company.

The Carpenter Steel Company has announced the promotion of **Joseph S. Pendleton,** Schuylkill Valley, from sales service metallurgist to metallurgist—tool and alloy steels.

Herman Schroll, Detroit, has been appointed branch manager for the Die Supply Division of E. W. Bliss Company, to be representative for sales and warehouse activities in the Detroit area.

Erwin G. Loewen, Little Rhody, has been appointed technical director of the Taft-Peirce Manufacturing Company, effective January 1, 1958.

Oliver H. Van Horn Company, Incorporated, of Houston, has recently announced the election of **M. M. Wiseman,** Houston, to vice president and general manager.

Announcement has been made of the appointment of **Lloyd Lee,** Detroit, as director of automation for LeMaire Tool & Manufacturing Company.

chapter activities

chapter news and views

chips and chatter

features index on page 123

chapter news and views

LONG ISLAND—Feasibility of a college of engineering on Long Island was discussed by this panel at special Oct. 28 meeting attended by 300 persons. Left to right are Warren J. Allen, engineering manager of Grumman Aircraft Engineering Corp.; Dr. Lawrence L. Jarvie, dean of State University of New York; Leon A. Rushmore, Jr., industrial relations manager, Long Island Lighting Co.; Dr. Francis K. Ballaine, dean of Adelphi College; T. Kenneth Ellington, vice president, Republic Aviation; Dr. Warren E. Wilson, engineering school dean, Pratt Institute; H. J. Campbell, Jr., Nassau chapter education chairman of State Society of Professional Engineers; and Douglas Hill, of Chapter 88, moderator at the session.

Long Island Panel Sees Need for New Schools; College of Engineering, Junior Colleges Advocated

A panel of educators and industrialists, brought together by Long Island chapter's education committee, agreed unanimously that a college of engineering is a necessity for the New York community.

The question, "Is a College of Engineering Needed on Long Island?" was posed to the panelists at an Oct. 28 meeting that drew 300 persons.

Douglas Hill, of Chapter 88, was moderator at the special meeting.

Dr. Lawrence L. Jarvie, executive dean of the State University of New York, said existing and planned engineering college facilities in the state would be filled to capacity by 1960. By 1956, he said, 4,900 would-be engineers will be turned away; by 1970, the turnaway total will have mounted to 5,200.

Studies by the State University indicated that Long Island was the logical site for a new college by reason of its population explosion, its rapid industrialization in recent years, and the possibility of linking the new facility with Brookhaven Laboratory. Present plans call for a state-operated, four-year college, as well as three two-year community colleges, devoted to preparing students for careers in science and engineering.

George Hauser, president of Liberty Aircraft Products and a member of Chapter 88, heads the Nassau County Commission of Collegiate Education, a group named by the county to study the need for more college-level facilities.

IBM and Epoxies Explored by Santa Clara

A turnout of 333 Santa Clara Valley members and their guests had the dual privilege of touring IBM's San Jose plant and hearing Walter J. Arrufat, of plastic tooling symposia fame (at the 1957 Houston convention) talk on plastic tooling for small parts. His lecture included slides showing how IBM uses plastics for tooling designed for the manufacture of their products, and a demonstration on the molding of epoxy resins showing with what simplicity this plastic material can be formed into jigs and fixtures for small parts.

A tour of the plant included visits to the assembly and testing stations of the new RAMAC (random access memory accounting computer) machine. The tour and the talk were preceded by dinner in the plant and a welcome by IBM management. —*Dresden Smith*

ERIE—Chairman H. W. Sedler (center) discusses technical meeting program with the speaker of the night, William E. Montgomery (left), chief carbide sales engineer for Firth-Sterling, Inc., and S. A. Fiorenzo, Erie chapter, first vice chairman. Fifty-three persons heard talk on carbides at the Dec. 3 session at the Polish Falcon Club. —*Leo B. Weiner*

ROCHESTER—Chairman Clifford Sears (left) introduces G. A. Ebelhare to members. Manager of Synthane Corporation, Mr. Ebelhare spoke on the processing and machining of laminated plastics. —*C. W. Greenman*

Chairmen Honored At Windsor Meeting

December sponsor of the Windsor December chapter meeting was Colonial Tool, Windsor, Ontario. Designated as past chairmen's night, ten of the chapter's 14 past chairmen attended. Mr. Norman, who was chairman in 1943, Windsor's chartering year, took over the reins and conducted the meeting after opening remarks by the current chairman. Committee reports were made by other past chairmen rather than by the usual committeemen.

Following the reports, a film, "Air Power by Bendix Aviation Corporation," was shown, which in turn was followed by the main speaker, Richard S. Hildreth, Michigan Tool Company, Detroit. He covered new developments in spline production. —*J. H. Kirkwood*

College Prexy Cites Canada's Engineer Needs

President of Waterloo College, J. C. Hagey, addressed some eighty members of Niagara District on the subject of "Canada's Need for Engineers," at the chapter's Dec. 6 technical session. Mr. Hagey stressed the importance of trained engineers and technicians to fill industrial jobs demanding increased technical knowledge, and discussed in detail the newly-formed engineering faculty now established at Waterloo College. He discussed the various courses available to high school graduates, and mentioned the appalling number of engineering students in universities who must drop out, largely for financial reasons.

Waterloo solves the problem with its cooperative system of education plus "on-the-job" experience, which allows students interested in eventual careers in engineering to combine both theoretical knowledge and practical experience during their training, so that upon graduation they may proceed at once into positions of responsibility. The income from the hours spent in working offsets the expenses of college.

At a previous meeting, members heard W. K. Voss, assistant superintendent of the Ontario Paper Mill discuss newsprint production. He pointed out that Canada produced five times as much pulpwood as neighboring countries, and named natural acid and alcohol as the two major by-products of paper making. The three main methods of processing wood for paper making are the mechanical or ground method, the sulfite method, and the sulfate method, he said. —*Leo Butticci*

HAMILTON DISTRICT—Archie Corkigian (left), Chapter 42 member, receives award which he won for his entry in the national gadgets contest from Chapter Chairman Harry Ward. —*Russ Wilson*

First Campus Session Planned by Canadians

Canadian tool engineers' first on-campus conference has been tentatively scheduled for April 12 at McMaster University, Hamilton.

Five southern Ontario chapters—Hamilton, Toronto, Grand River Valley, Niagara, and London-St. Thomas—will sponsor the one-day, four-speaker program.

A conference committee was chosen at an organizational meeting at Hamilton, Dec. 14, consisting of W. A. Dawson, Hamilton, general chairman; Eric Browne, Toronto, vice chairman; R. Wilson, Hamilton, secretary; W. Durrant, Hamilton, treasurer; W. Buchanan, Toronto, program chairman; and George Churchill, Hamilton, registration chairman. The committee met Jan. 25 at McMaster University.

Talk on Press Brakes Heard at Toronto Meeting

"Press Brake Equipment" was the subject of a presentation given at Toronto's November meeting by A. G. Baumgartner, sales manager, Cincinnati Shaper Company. Mr. Baumgartner enlarged upon the development of shearing on highly finished stock, using the press brakes as punch presses, and the development of methods of shipping, slug removal and, more recently, the variable speed clutch, an important factor in operation safety where high-speed forming on large stiff parts and the resultant whip of overhang sections are dangerous.

Robert Innes and R. E. Jacobs from Cincinnati Shaper Company were introduced by Les Joyce, sales manager of Upton, Bradeen and James, and they, with Speaker Baumgartner, formed a discussion panel, ending in a lively question period. —*R. A. Flannagan*

GOLDEN GATE—Model of an optical tooling setup is explained by Frank Lamphere, field engineer for Charles Bruning Co., as Program Chairman Noel Frisch (left) listens in. Movies and slides also supplemented Mr. Lampher's talk on this method of inspection, before 130 persons at the Nov. 20 meeting in the Villa de la Paix, Oakland, Calif.

Chapter news and views

ATLANTA—Chairman H. P. Ulrickson (right front) of Chapter 61 directs group's attention to point of interest during November tour of Lockheed Aircraft's Marietta, Georgia, plant. In background is C-130 Hercules, built for the Air Force at Marietta. More than 150 members and guests on the tour also got a sneak preview of the "Jet Star," latest of the Lockheed family of planes. —*J. W. Vissage*

LONG BEACH—"The Tool Engineer, Yesterday, Today, and Tomorrow" was the topic of this panel brought together for Chapter 84's Industry and Education Night. Left to right are Irvin Also, program chairman; Fredrick Preator, tool engineering professor at Utah State University; Wayne Ewing, ASTE vice president and head of Arrowsmith Tool & Die Corp.; T. T. Woodson, vice president, engineering, Waste King Corp.; K. G. Farrar, vice president and general manager, Douglas Aircraft; and R. E. Gariss, panel moderator, senior tool design engineer, Douglas.

SAN FERNANDO VALLEY—Chapter officers pose with guest speaker Robert W. Fitzpatrick (front center), sales representative of IBM, after his lecture on electronic data processing machines. At left in front is John Bethune, first vice chairman, with Robert Broomell at right. Standing are Robert Edgecomb, secretary; Charles Goodspeed, treasurer; Tom Tomlinson, second vice chairman. —*R. E. Ditrick*

Tool Engineer Editor Joins Advertising Firm

Robert A. Wason, associate editor who, under Editor Jack Greve, headed the technical writing staff of THE TOOL ENGINEER for the past four and a half years, has resigned his post to become editorial director of Denham & Company, a Detroit advertising agency handling industrial accounts. Mr. Wason's responsibilities while on the magazine staff included the regular monthly feature, "Designed for Production," the editing of articles by contributing authors, and the conception and preparation of countless technical articles describing techniques and processes of interest to the tool engineer.

Prior to joining the magazine, Mr. Wason, a mechanical engineering graduate of Stevens Institute of Technology, had been associated with McGraw-Hill as news editor on *Product Engineering*, and had helped to establish *Purchasing News* for Rogers Publishing Company while serving as eastern editor for *Design News*. He has contributed numerous free lance articles to other technical magazines, and has written several sections for the Encyclopedia Americana.

Tools for Teachers Urged at Mid-Hudson

Although industry's tools have been modernized, teachers of today use tools of 1890 on their students—the raw material of industry—Patrick Beatts, director of education of IBM-Poughkeepsie, told the annual industry-education night meeting of Mid-Hudson chapter.

In a talk entitled "Television—Teaching Tool or Gimmick," Mr. Beatts argued that TV is the tool which can bring instruction out of the blackboard-and-chalk era. In his opinion, television will be the salvation of the teacher shortage and the anticipated extra student load in the nation's schools.

He answered educators' contentions that the personal touch will be lost, by demonstrating with slides the contrast between a lecturer seen as a mere dot by the majority in a large class, and the close-up of a lecturer as seen on the telescopic eye of TV.

Seventy-one persons attended the meeting at Mirabell, including area college and secondary school leaders.

Missiles, Cans, and Data Processing Are Starred at San Fernando Valley

IBM Sales Representative Robert W. Fitzpatrick gave San Fernando Valley members a look into the future with his facts and figures on electronic data processing equipment now available. He disclosed that data can be recorded on punched cards automatically from such varying sources as radio, telephone, telegraph, digitalized recording instruments or as documents are typed. This information can be converted to magnetic tape or can serve as direct input to data processing machines or systems which calculate, rearrange, do table look-up and process current data with master data and historical data stored on magnetic tapes, drums or disks.

These procedures produce updated master files and finished results which can be recorded into punched cards, magnetic tape, magnetic disk files or printed reports. The vast storage capacity for millions of facts and the unique ability to retrieve them without searching is proving to be economical.

The continuous-line processing of thin gage sheet metal into cans and specially treated paper into milk cartons was viewed by members who toured the American Can Company November 21. They noted that, aside from manual labor at the raw material loading and finished product unloading stations, all-automatic equipment moves material at unbelievable speeds through the various phases of production such as shearing, slicing, forming, soldering, stapling, gluing, colorprinting and labeling. One example of the production rate cited was 24,000 small beer cans per hour.

Methods of missile manufacture was the subject of an earlier November meeting when Thomas Vejda, Lockheed Aircraft, told his audience of the crash program now underway to gather all possible information for design improvement and testing. He told of the constant re-evaluation of theories, material and tooling, and of the adaptation of adjustable tooling, based on the rapid changes taking place as new designs are adopted. —*R. E. Ditrick*

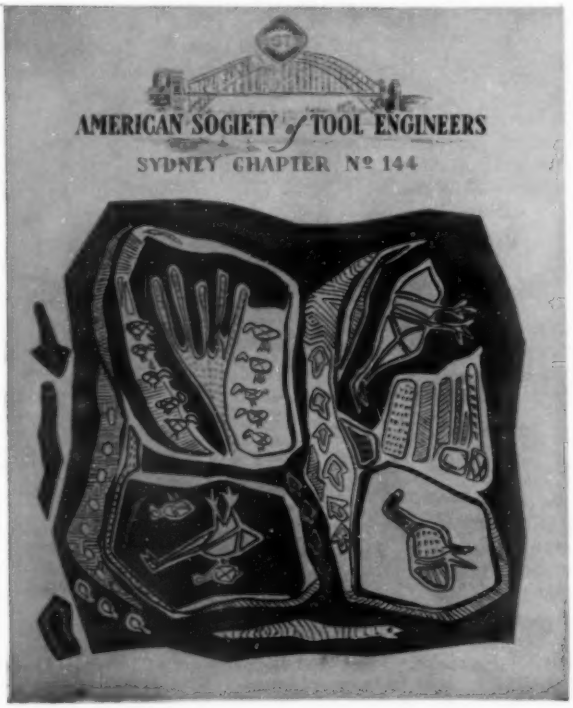
LONG ISLAND—Chairman Ted Borecki (left) presents scholarship awards of $125 each to Robert W. Carter and William E. Schneider (right). The 1958 winners were chosen on the basis of work at Long Island Agricultural and Technical Institute and essays on "What Lies Ahead for Me as a Tool Engineer."

Greeting Card From Down Under Adds Zest to Staff's Season

An unusual salutation from Australia, signed by members of Sydney Chapter 144, has proved a source of delight for the ASTE Headquarters Staff.

The greeting card, two pages of which are reproduced here, contained the charming aboriginal depiction of the fable of the turkey and the wingless emu. It was embellished by the hand-drawn ASTE symbol and legend.

The card, by the way, came via man-made wings.



AUSTRALIAN ABORIGINAL LEGEND
(FRONT)
of
DINEWAN the EMU
and GOOMBLE-GUBBON the TURKEY

The story tells of how Goomble-Gubbon the Turkey mother, through jealousy, wished to depose Dinewan the Emu as king of the plains, and so tricked the Dinewan mother into cutting off her own wings. (Can you see the tomahawk she used?) In return, Dinewan hid ten of her twelve chicks by the big-salt bush, and taking two of them up to Goomble-Gubbon, told her she could never be king because of her small size, reasoning that whereas Goomble-Gubbon had twelve chicks to feed, the Emu could apparently concentrate on just two. G.G. killed ten of her chicks only to find that Dinewan really had twelve.

"We are quits now" said Dinewan, and to this day the Emu has no wings and the Turkey of the plains lays only two eggs each season.

chips and chatter

Hartford

At The Hedges, Jan. 6, following a social hour and dinner, Richard E. Leary, technical sales representative for E. I. du Pont de Nemours & Co., spoke on "The Mechanical Applications of Plastics." He reported on various types of plastic applications and problems in design and manufacturing, with the aid of slides and models.

Dayton

Nineteen initiates were presented membership pins at the Nov. 18 meeting in Sutmillers, attended by 90. Edwin Stouten, chairman of the Grand Rapids ASTE chapter and owner of the Capitol Engineering Co., showed slides and explained how the Barrett Die-Draulic Grip is being widely used in the stamping industry as a replacement for springs, air cushions, and rubber pads in dies. C. A. Barrett, of Die-Draulic, Inc., in Grand Rapids, also spoke.

Keystone

Examples of automatic assembly techniques were seen by members on a plant tour of the Atlas Chain Co. plant, West Pittston, Pa., on the occasion of the Dec. 9 meeting held for the Wilkes-Barre area. Group gathered at Bonnie's Restaurant, in Exeter.

Lansing

Seventy members toured the Fisher Body plant in Lansing on Dec. 16, observing operations in the body, paint, trim, and cut-and-sew departments.

Chicago

Smorgasbord, dancing, and a gift for each woman featured the Christmas party Dec. 9 at Nielsen's. "Melody Brothers" furnished the music for the 220 present.

Kokomo

December meeting of Chapter 137 drew 45 guests and prospective new members. John A. Harrington, chief tool engineer of the DoAll Co., spoke on the technical and practical approaches to surface grinding problems.

Mississippi

Tooling for induction heating was discussed by Dr. H. B. Osborn, technical director, Tocco Div., Ohio Crankshaft Co., at a meeting attended by 31 in the Edwards Hotel, Dec. 9. Dr. Osborn showed slides illustrating automated induction heating equipment, and new developments in brazing, soldering, welding, and annealing.

At the Jan. 17 meeting, Walthall Hotel, John A. Mueller, manager, Grinding Laboratory, was the speaker.

Des Moines

"Cutting Oils, Their Relationship to Machinability" was the subject of a talk by J. S. Taylor of Socony Mobile Oil Co. at the Dec. 11 meeting at the Country Club. J. E. Scanland, vice president-engineering, New Monarch Machine and Stamping Co., also spoke. Forty members attended.

Calumet Area

Cast iron metallurgy and its relation to casting design, illustrated by color slides, featured the technical session Nov. 25 at Phil Smidt & Son Restaurant in Whiting. The speaker, Charles Ford, Meonite Metal Corp. foundry engineer, cited advantages in product quality, productivity, and margin of profit realized when foundry practice dictates to design and material engineers.

Portland, Me.

Thirty-two persons heard some pointers on milling at the Jan. 3 meeting in the Falmouth Hotel. C. Jenness Cameron, of the Lovejoy Tool Co., Springfield, Vt., and past chairman of Twin States chapter, was the speaker.

Milwaukee

W. S. Wagner, development engineer for E. W. Bliss Co., spoke on "Deep Drawing Operations and Presses" at the Dec. 12 technical meeting in the Serb Memorial Hall. Slides and two movies showing transfer feed presses in operation illustrated his talk. Members and guests totaled 101.

Chapter 4 turned out in strength—222—for the annual hospitality night at Allen Bradley Co., Nov. 14.

Little Rock

Christmas party drew 25 couples Dec. 6 to Tia-Wanna.

Grand Rapids

Joint meeting with the local chapter of the American Society of Quality Control was held at Park Church, Dec. 9. Speaker was C. G. Schelly, director of the Wilkie Foundation, on development of measuring tools.

Little Rhody

Approximately 200 members and guests attended the Christmas party in conjunction with the R. I. Tool and Die Assn. The party was held at Johnson's Hummocks, Dec. 7.

Akron

Aspects of titanium were discussed by a trio of experts at the Dec. 17 program, held at Iacomini's. George A. Irwin, tool research, Goodyear Aircraft, talked on titanium as concerned with stretch press and drop hammer operations; Marvin Seese, Goodyear welding engineer, described titanium welding; and Emery J. Van Boven, project engineer for Firestone Tire and Rubber Co., spoke on milling, drilling, and threading the metal.

St. Louis

An excellent talk was given by Emery P. Miller, director of research and development, Ransburg Electro-Coating Corp. His talk covered the Ransburg Electro-Coating process, was accompanied by films and followed by a question and answer period.

On Dec. 14, the chapter held their annual Christmas party at the Coronado Hotel. Two hundred couples enjoyed dinner and dancing.

Evansville

Dinner, fashion show, and dancing featured the ladies night meeting Dec. 9 at Hotel McCurdy. 188 attended.

Birmingham

Role of waxes as cutting fluids and lubricants in metalworking was discussed by Arthur J. Langlois, sales engineer, Johnson's Wax Co., at the Nov. 21 technical-dinner meeting at Thomas Jefferson Hotel. A nominating committee composed of Bob Ford, Bill Gillies, and Ray Mauldin was elected. Thirty-two attended.

Chautauqua-Warren

Elected to the chapter nominating committee at the Nov. 21 meeting were Past Chairman R. J. Wilson, Jr., Herbert Cave, and Gordon H. Carlson. A. R. Davidson, president of the Davidson Electronic Development Co., spoke on "Application of Electronic Controls to Existing Equipment" before the 53 members and guests at the Warren, Pa., meeting.

Arthur M. Jackes, chief of propulsion analysis, Bell Aircraft Corp., discussed latest developments in the VTOL (vertical take-off and land) type of aircraft, at the Dec. 19 meeting in Hilltop Hall, Jamestown, N. Y.

Nebraska

Tours of the Lincoln, Neb. plants of Sealrite Mfg. Co., Woodcraft, Inc., Weatherseal, and Metalcraft Engineering Co. were made by members after the meeting in the Cornhusker Hotel Dec. 12.

Lima

Dinner dance was held at the Clemans Building, Dec. 7. One hundred eighty persons attended, 40 of whom received door prizes. Dancing followed a steak dinner.

Saginaw Valley

Two hundred thirty members and guests enjoyed the program arranged by Jim Elliott and his committee at the dinner dance and ladies night Christmas party Dec. 7 at Zehnder's Hotel in Frankenmuth. Comedy entertainment and dancing to the strains of Ed Berry's orchestra made for an entertaining evening.

Worcester

Sixty-three members and their wives attended the ladies night and Christmas party held at Putnam & Thurston's Restaurant Dec. 7. A social hour followed

by dinner started the evening off and many gifts were distributed to the ladies present by Santa Claus, under the able direction of Dan Hoyt, first vice president and program chairman, who acted as toastmaster. Dancing with music by George Gregory followed.

DES MOINES—J. E. Scanland (right), vice president-engineering of New Monarch Machine & Stamping Co., explains drawing process of new gasoline tank to J. L. Taylor, Socony Mobil Oil Co., at December technical meeting.—*John Hug*

Springfield, Ohio

Dinner, gifts, flowers for the women, and dancing filled the evening as the chapter held its Christmas party Dec. 14 at the Shrine Club. Entertainment was by Jack Davis, Cincinnati.

Muncie

William G. Schmidt, sales engineer, Gisholt Machine Co., showed films to illustrate his talk Jan. 7 on "The Nature of Balancing." Technical meeting was held at the Delaware Hotel.

Chips and Chatter

PATERSON—At the final lecture of the chapter's tool steel seminar, members received certificates showing completion of the course. Participants shown from left are: Chairman Robert Neeb, displaying certificate; Ben Kluger; Charles Winschu; Crucible Steel Representative Robert Eason, the final speaker in the seminar; J. G. Thomas; and C. Buscema. —*J. Jowett*

Paterson

Steel making in Sweden was described by Uddeholm Steel Co.'s Vice President Dutcher, at the Jan. 6 technical meeting in Brownstone Inn. Mr. Dutcher showed a color, sound movie to illustrate his lecture, and gave a book on the history of his firm to each of the 45 members at the meeting.

Denver

Fifty-five members and guests attended the regular meeting Nov. 14 at the Legion Post. F. J. Geoffroy reported that the Omaha, Wichita, Kansas City, Tulsa, Oklahoma City, Ozark, and Southeast Kansas groups have been invited to attend the Rocky Mountain executive conference in April, 1958. Paul J. Garmus, of Timken Roller Bearing Co., talked on "Graphitic Steels."

Northwestern Pennsylvania

Harold L. Strauss, Jr., National Diamond Laboratories, presented a talk covering techniques and usages of industrial diamond products — wheels, hones, tools, powders, etc., at the Jan. 2 meeting at the Moose Home in Emporium. Forty-six members were in attendance.

Binghamton

Eighty-five couples attended the ladies night meeting Dec. 6 at the Vestal Legion hall in Castle Creek. Each woman received a Christmas corsage. Dancing followed the lobster or turkey dinner.

San Gabriel Valley

Dr. Joseph Platt of Harvey S. Mudd College, George Exley of Convair-Pomona, and Ben Berlien, ASTE national director, were speakers at the Dec. 5 industry and education night in the Rainbow Angling Club, Azusa, Calif.

Phoenix

Sixty-five persons attended the Christmas social gathering at Green Gables, Dec. 15. Music, entertainment, and dancing followed a filet mignon dinner.

Northern New Jersey

Charter members and past chairmen got certificates of appreciation at the Dec. 10 meeting marking the 20th anniversary of the chapter. J. S. Broatch, sales engineer for Pratt & Whitney, spoke on "Gaging and Automation."

Piedmont

"Production for Finish" was the lecture subject at both the north area Piedmont meeting at Greensboro, N. C., Dec. 9, and the south area session next day at Charlotte. Lee W. Sherrill, Minnesota Mining & Mfg. Co., spoke at Greensboro; O. L. Pederson, of the same firm, was the Charlotte speaker.

DAYTON—Speakers of the evening line up with Chairman George W. Brandt (second from left). At left is E. E. Walker, president of E. E. Walker Co., Dayton, who introduced Edwin Stouten, operator of Capitol Engineering Co., Grand Rapids, Mich., and C. A. Barrett (far right), of the Die-Draulic Grip Co., Inc., Grand Rapids. —*Earl E. Todd, Jr.*

New Uses for Isotopes Predicted by Engineer

New uses of radioactive isotopes in tool engineering were predicted at the December meeting of Hamilton Chapter 42. The speaker was M. T. Neill, sales engineer for Curtiss-Wright of Canada, Ltd., of Oakville, Ont.

In a talk entitled "Atomic Energy and the Tool Engineer," Mr. Neill said there had been a tremendous surge in the use of isotopes in industry since 1946. More than 4,000 organizations in Canada and the United States are licensed to use isotope products now.

Although utilization of isotopes in tool engineering has been rather limited to date, the speaker said, research will open up new uses. So far, isotopes have been employed as tracers to investigate tool problems such as friction, lubricants, tool wear and cutting tool performance. They have also been used in metallurgy for new developments.

Isotopes, Mr. Neill explained, are used in four ways: in instrumentation techniques to automatically control processes in the paper, rubber, and plastics industries; in the inspection field, where cobalt and iridium have replaced X-ray in inspection of welds, castings, and forgings; as tracers in the biological and process industries; and to increase the storage life of food.

Eight past chairmen of the Hamilton chapter sat at the head table in the meeting in Fischer's Hotel. They were: W. A. Dawson, charter chairman, 1941; C. A. Fisher, 1942; J. N. Walton, 1946; George Churchill, 1950; C. W. Bulmer, 1953; J. M. Snyder, 1954; F. C. Johnson, 1955; J. A. Sheldon, 1956.

CALUMET AREA—Discussing lecture on foundry practices at the chapter's technical meeting in Whiting, Ind., are (front table, left to right) C. Scherer, tool engineer, GATX; W. F. Petersen, tool designer, Aero-Matic Engineering; B. W. Clark, senior engineer, Kaiser Aluminum and Chemical Corp.; and C. Mitchell, plant manager, GATX plant No. 3. *—John R. Albrecht*

Tooling Text List Available

A bibliography of textual and reference books on tool engineering subjects has been compiled by the Society's national education committee.

The list is now available on request without charge from Headquarters, American Society of Tool Engineers, 10700 Puritan Avenue, Detroit 38, Mich.

WORCESTER—Mrs. Mary Hoyt, wife of Worcester's first vice chairman, perches on Santa's knee to tell him what she wants for Christmas, at the annual holiday Ladies Night program. In line behind her are her husband (left), Mrs. and Mr. A. U. Maynard (he, membership chairman), and the Reynald Sansoucy's. Mr. Sansoucy was chairman of the arrangements committee. *—R. A. Cusson*

Rockford Repercussions

Wife Questions Method Of Selecting Numbers

Repercussions of the coin-and-die method of selecting random numbers, as published in the August issue, have come from the wife of one of the men in the 454-member Rockford chapter. Mrs. Nels Balestri, a former high school mathematics teacher, whose husband obviously has a low number in Rockford's alphabetical list of members, raises the question of how one-digit and two-digit numbers can ever be chosen, if the coin and die are always tossed three times in order to generate a three-digit number.

To review the formula, the toss of a penny and a six-sided die is interpreted as follows: 'heads' on the penny adds three to the point on the die; 'tails' subtracts two from the point rolled; and if an ace comes up on the die, the toss is made again. The first toss generates a single random digit, with subsequent throws being made for each digit position. With over 400 men in the Rockford chapter, the throws for attendance prize would always be three in number, which worried Mrs. Balestri.

In case other chapters may have run into the same problem, here is the answer given Mrs. Balestri by Ed Varnum, the Rockford mathematician who 'discovered' the method: The first man on the list has the number 001; the second, 002; etc. The fourteenth man's number is 014, and the thirty-seventh, 037. The first throw will generate a zero with the same probability as any other digit: This gives the first hundred men on the list the same chance of being selected as the second or any other hundred.

Coming Meetings

ASTE Tool Show and 26th Annual Meeting, May 1 through 8, at Philadelphia. Show at Philadelphia Convention Center.

Chapter

CALUMET AREA—Feb. 24, 6:30 p.m., Phil Smidt & Son Restaurant, Whiting. "Large and Small Lots Gaging" and film by W. F. Jenks and A. H. Johnson, Pratt & Whitney.

CEDAR RAPIDS—Feb. 13, 6:30 p.m., Sheraton Montrose Hotel. "Plastic Tooling" by Frank J. Boehm, Jr. Laboratory demonstration and a film.

CHAUTAUQUA-WARREN—Feb. 15, 7 p.m., Viking Temple, Jamestown. Ladies night and dancing.

DES MOINES—Feb. 12, 7 p.m., Des Moines Golf & Country Club. "Tool Engineers in Utah" by Les Seager, national director. Education Night and election of officers.

ERIE—Feb. 4, 6:30 p.m., General Electric Community Center. "Vibratory Parts and Materials-Handling Equipment" by W. McKinsey, Jr., manager, Parts Handling Equipment Dept., Syntron Company. Election night.

FOX RIVER VALLEY—Jan. 28, 6:45 p.m., St. Charles Vets Club. "Automatic Welding Fixtures" by C. C. Peck of C. C. Peck Co. Introduction of new members; presentation of pin and kits.

GREATER NEW YORK—Feb. 3, 8:30 p.m., Hotel New Yorker. "Use of Air Power Devices for Handling and Positioning Parts in Production" by H. S. Cadieux, New York district manager, The Bellows Co.

HAMILTON DISTRICT—Feb. 14, 6:30 p.m., Brant Hotel. "Ceramic Cutting Tools" by G. W. Barnes, Norton Co.

INDIANAPOLIS—Feb. 6, 8 p.m., 40-8 Chateau. "The Role of Coolants in Machine and Grinding of Metals" by C. A. Sluhan, president, Master Chemical Corp.

JACKSON—Feb. 17, 7 p.m., Arbor Hills Country Club. "The Society's Research Activities, Current and Future" by Col. L. S. Fletcher, research fund director, ASTE.

KEYSTONE—Feb. 17, 6:30 p.m., Castle Restaurant, Scranton. "Automation" by Orland Sayre, sales engineer, The Bellows Corp.

LITTLE ROCK—Feb. 13, 7:30 p.m., Hank's Dog House. "Metal Stitching," by John Trout, Acme Steel Co., Product Div. Election of officers.

LONDON-ST. THOMAS—Feb. 21, 8 p.m., Electric Autolite, Ltd., Sarnia. Plant tour.

MERRIMACK VALLEY—Feb. 6, 6:45 p.m., Greenridge Turkey Farm Restaurant, Nashua. "The Selection and Heat Treatment of Alloy Steels" by Norman N. Brown, assistant to the president, Wheelock, Lovejoy and Co.

MILWAUKEE—Feb. 13, 6:30, American Serb Memorial Hall. "Proper Selection of Grinding Wheels" by Charles E. Van Riper, Norton Company.

MISSISSIPPI—Feb. 3, 7 p.m., American Bosch Co., Columbus. Plant tour.

MONTREAL—Feb. 19, 7:45 p.m., Canadian Legion. "Story of Measurement," representative of DoAll—Eastern Canada, Ltd.

MUNCIE—Feb. 4, 6 p.m., Empire Room, Delaware Hotel. "Turning and Tracing" by Edward Raber, Automatic Machine Tool Co.

NEBRASKA—Feb. 20, 7 p.m., Omaha. Talk by Les Seager, Salt Lake City, national ASTE director. Election.

NORTHERN NEW JERSEY—Feb. 11, 8 p.m., Essex House Hotel, Newark. Talk on standards by George McLaughlin, area standards committee chairman. Film on automation produced by Westinghouse. Election.

NORTHWESTERN PENNSYLVANIA—Feb. 6, 6:30 p.m., Legion Home, St. Marys, Pa. Technical session: "Precision Barrel Finishing" by Donald A. Mosher, Elmira Heights, N. Y., president of BMT Mfg. Corp.

OTTAWA VALLEY—Feb. 18, 8 p.m., National Museum. "Story of Measurement" by Albert Sawyer, DoAll—Eastern Canada, Ltd.

PATERSON—Feb. 3, 8 p.m., Brownstone House. "Tools and Dies" by Al Elston, Mack Truck Co.

PHILADELPHIA—Feb. 21, 7:30 p.m., Engineers Club. "Tool and Die Design" by Robert Hohl, chief engineer press shop tooling, Standard Pressed Steel.

PIEDMONT—Northern Area: Feb. 10, 6:30 p.m., Greensboro, N.C. Southern Area: Feb. 11, 6:30 p.m., Charlotte, N.C. "Applications, Limitations, and Economies of Throwaway Insert Carbide Tooling" by W. L. Kennicott, chief engineer, Kennametal, Inc., at both meetings.

PORTLAND, ME.—Feb. 7, 7 p.m., Falmouth Hotel. Talk on coolants by representative of S. C. Johnson & Sons, Inc. Election of officers.

PORTLAND, ORE.—Feb. 20, 6:30 p.m., Burns Restaurant. "Carburizing" by James Bates, Hyster Co.; "Heat Treating of Stainless Steel" by William Rice, metallurgist, Electric Steel Co. Election of officers.

ROCHESTER—Feb. 3, 8 p.m., Barnard's Exempt Club. Panel on dies, jigs and fixtures, gages, screw machines.

SAGINAW VALLEY—Feb. 13, 7 p.m., Zehnder's, Frankenmuth, Mich. "Diamond in Industry" by Everett Sinclair, grinding engineer, Norton Co.

SAN FERNANDO VALLEY—Feb. 5, 8 p.m., Hody's Restaurant, North Hollywood. "Welding Tooling for Missile Production" by B. R. Russell, president of Airline Welding & Engineering.

SCHUYLKILL VALLEY—Feb. 11, 6:30 p.m., Berkshire Hotel, Reading, Pa. "Air Gaging" by F. Meyer, Jr., manager, instrument gage division of Taft-Peirce Mfg. Co.

SPRINGFIELD—Feb. 12, 6:30 p.m., Everglades, Columbus, O. Joint meeting with Columbus chapter. "Foreign Vs. American Machine Tools" by ASTE President Harold E. Collins.

ST. LOUIS—Feb. 6, 6:30 p.m., Rugger's. Old-timers night, election of officers.

TRI-CITIES—Feb. 12, 6:30 p.m., Legion Club, Moline, Ill. Talks by C. A. Barrett, research engineer, Die-Draulic, Inc., and Ed Stouten, owner, Capitol Engineering Co., Grand Rapids.

TWIN CITIES—Feb. 5, 6:30 p.m., Coleman's Restaurant, St. Paul, Minn. "Turret Punch Presses as Production Aids" by John H. Powers, sales manager, Wiedemann Machine Co. Film.

WINDSOR—Feb. 10, 7:30 p.m., Prince Edward Hotel. "Ceramic Tooling, A Challenge of Physical Properties" by George W. Barnes, of Norton Co. Norbide Div., Hamilton, Ont.

WORCESTER—Feb. 4, 6:30 p.m., Boy's Trade High School. "Story of Measurement" by C. G. Schelley, Wilkie Foundation director, DoAll Co.

Obituaries

Leslie L. Thill, Calumet Area, superintendent of manufacturing with Barco Manufacturing Company. Mr. Thill was charter chairman of Calumet chapter and was highly regarded in the tool engineer industry.

Norbert A. Heyer, member-at-large, project engineer for O'Sullivan Rubber Corporation.

Alexander Gabay, Golden Gate, November 12, 1957. One of the original 60 founders of ASTE and a charter member of Santa Clara Valley, Mr. Gabay was, at the time of his death, connected with the firm, Business and Engineering Associates, Cupertino, California, as a consulting engineer.

Lloyd V. Harding, Detroit, development engineer, The Cross Company.

Lester F. Lewellen, Dayton, machinery designer, Shartle Brothers.

James M. Millikin, Buffalo-Niagara Frontier, tool superintendent, Twin Coach Company.

William J. Noth, Buffalo-Niagara Frontier, National Editorial Committee chairman 1944 and 1945 and, at the time of his death, tool engineer, Phinney Tool and Die, Incorporated.

Sher M. Quraishi, Macomb County, gage processing analyst, Department of the Army, Detroit Arsenal.

Russell H. Rideout, Buffalo-Niagara Frontier, chief engineer, Buffalo Forge Company. Mr. Rideout was National Membership chairman from 1944 to 1947.

Eric H. Modin, Fox River Valley, superintendent of Oak Manufacturing Company.

S. R. Swenson, Chicago, chairman of the Board and treasurer, Midwestern Tool Company.

Olin Wilson, Calumet Area, general mechanical foreman, Inland Steel Company.

William Kerr Stamets, Pittsburgh, chairman of the board and president of William K. Stamets Company. Past president of American Machine Tool Distributors Association, Mr. Stamets was also president and chairman of the Enterprise Company of Columbiana, Ohio and the Stamets Export Company of Pittsburgh.

Herman J. Steinmetz, New Haven, general foreman for Waterbury-Farrel Foundry. Mr. Steinmetz was chairman of the National Education and Training Committee 1947-48.

Herbert J. Poosch, Oakland Company, tool engineer for Federal Engineering Company.

Oscar W. Cooper, Fairfield County, member of National Constitution and Bylaws Committee 1947-48 and chief methods engineer for Pitney-Bowes, Incorporated.

Walter F. Wilhelm, Dayton, machine designer at East Dayton Tool and Die Company.

William E. Mackie, Detroit, chief checker tool engineer, Time Engineering Company.

Ernest Rockafellow, Saginaw Valley, owner of Automation Design and Engineering Company.

Irwin Dolansky, Cleveland, tool designer for Jack and Heintz.

George D. Sills, Peoria, estimator for Caterpillar Tractor Company.

Thornton W. Mackay, Little Rhody, methods engineer for Foxboro Company.

Reinhold Young, New Haven, tool designer for Sargent & Company.

Earl Fred Sager, Pittsburgh, finishing division superintendent, Walworth Company.

A NEW FIRST is making history

the IDEAL DRIVING CENTER

For the first time, on work held between centers—chucking and clamping time are eliminated; unobstructed end-to-end machining is possible

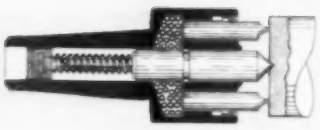
So new and different that we dare to use the word *revolutionary!* You have used live centers for years—now we give you a new word for your shop vocabulary: the Driving Center.

The action of the IDEAL Driving Center is simplicity itself—basic hydraulic and friction principles, with steel balls taking the place of a fluid, provide its operating action.

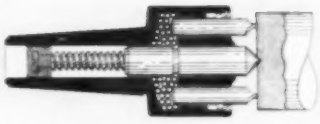
The IDEAL Driving Center is another step in the direction of automation. Spectacular time savings can be achieved through elimination of chucking and clamping, by end-to-end machining without removing the work, loading and unloading without stopping the machine.

The Driving Center provides a rigid, direct drive, without backlash; there are no problems with slack or chatter; the unit functions equally well with uniform work pieces, rough castings, forgings, other uneven shapes or surfaces.

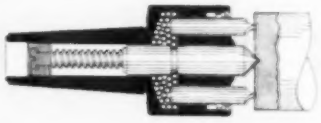
Available to fit Morse tapers No. 2 to No. 6, work diameters from .407" to 6.375". Call or write us today. We'll be glad to rush you complete details and prices.



Free-wheeling, the centering pin, held in its maximum extended position by the spring, engages the work surface first. The horizontally free moving "driving pins", their ends floating in a "fluid" of hardened steel balls, have not yet made contact with the work.



As the tailstock ram moves the work into position against the driving pins, the centering pin is forced back into the driving-center head against the pressure of the spring. The flat ends of the driving pins are forced into the mass of steel balls, starting to pack them more tightly.



Finally the pin ends are forced so deeply into the mass of balls that no further longitudinal movement is possible. The fluid action of the balls distributes pressure evenly, so that each pin is driven into the work face with equal pressure. Some of the balls slip into the grooves around the circumference of the centering pin where they jam so tightly that the centering pin cannot move back further in its cylinder.

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Please send me prices and complete information on the operation and application of the new Ideal Driving Centers.

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PROGRESS IN PRODUCTION

AUTOMATICALLY SEQUENCED WATER-HYDRAULIC PRESS PUT TO WORK IN ALUMINUM PLANT

An automatically sequenced water-hydraulic extrusion press is now in operation at Kaiser Aluminum & Chemical Corp. It is so designed that it can be operated automatically or manually to extrude billets 9 to 12 in. in diameter and up to 36 in. in length. It can be run on automatic cycle up to any point in the process and then operated manually.

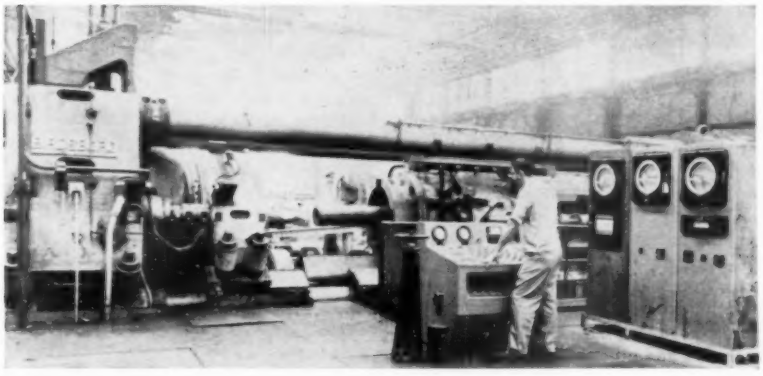
Switchover point from automatic to manual operation or vice-versa can be preselected.

Main ram of the press exerts a force up to 3500 tons, while maximum of the mandrel piercer is 250 tons. Ram, mandrel piercer, container, gate locks and shear are all operated by water at 4250 psi. Billet loader and die carrier, however, are oil hydraulically operated at 750 psi.

Principal feature of the machine is its built-in automatic cycle control for movement of the main moving crosshead. This system, employing a water operated oil hydraulic servo arrangement, controls the main ram fast advance (the extrusion stroke) and the return stroke to starting position. Two electrical circuits energize and de-energize solenoid operated valves through limit switches, automatically controlling all elements of the press through the entire extrusion cycle. The limit switches actuate the larger hydraulic valves and set various parts of the machinery into action.

Electrical interlocking of the moving components prevents out-of-sequence operation during the automatic cycle or carelessness in manual operation.

The press was designed and built by Birdsboro Steel Foundry & Machine Co. to extrude a range of aluminum tube sizes and assorted shapes at Kaiser Aluminum & Chemical Corp.



POWDER METAL TECHNIQUE BROADENS INDUSTRIAL USE

Expanded industrial use of precision parts made of powder iron and steel alloys is anticipated as a result of a new powder metallurgy process developed by P. R. Mallory & Co. Inc. The process, called Steelmet, is capable of producing intricate components with properties comparable to machine wrought parts.

Important aspect of the technical development is the fact that it appears

Ductility of alloys made by Steelmet process makes it possible to produce intricate parts from powder iron for high stress applications. The same composition was used for both the gear at the left and the steel bar which has been twisted two full turns.

to close the physical property gap that has previously limited broad usage of ferrous powder metallurgical parts in highly stressed structural applications. With the Steelmet process, according to Dr. F. R. Hensel, Mallory vice-president in charge of engineering, "it will become feasible to produce by powder metallurgy many precision parts for industry such as gears, cams, levers, pawls, ratchets which now are pro-

duced by more expensive machining methods." He cites as an example of this point a small part now supplied by the new process for less than 25 cents which would cost more than four times as much if produced as a wrought part.

During the several years of research preceding development for the technique, efforts were concentrated on using cheaper grades of commercial iron powders as the basic raw material. This was done in order to make the development applicable to the widest possible market in the structural applications field.

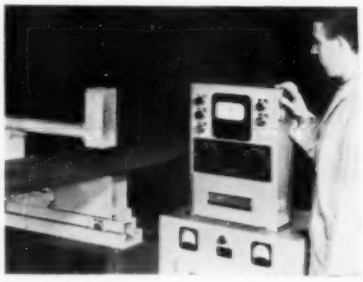
During its preparatory work, the company succeeded in producing a variety of iron alloy powders of closely controlled particle size and particle size distribution. Carefully controlled thermal, physical-chemical and mechanical steps have achieved raw materials which can be converted by a single pressing and sintering operation to many iron alloy compositions which are at least 95 percent dense. Thus there is no need for such techniques as copper infiltration, multiple pressing and sintering or hot pressing.

Flanged bushings made of powder iron alloys are unloaded from a sintering furnace in Mallory's Steelmet pilot plant in Indianapolis.

Development of the technique has earned for Mallory the Industrial Science Achievement award presented annually by the American Association for the Advancement of Science to a company which develops a practical application of a basic scientific discovery.

GAGE MEASURES THICKNESS BY ELECTRONIC PULSES

Film and foil speeding by at 100 fps is scanned by low-intensity x-rays in split second pulses which measure strips 0.0002 in. thick with accuracy of millionths of an inch. This Measuray R gage, developed by The Sheffield Corp., uses pulses instead of continuous radiation, and pinpoints changes of thickness during extremely high speed. At 600 pulses per second, the new gage provides an individual thickness reading every third of an inch on foil fed through at 1000 fpm. It may be utilized on plastic film, foils of steel, aluminum, copper or brass, and on sheet and bar stock. Up to 36,000 individual readings per minute can be taken on strip.



Ultra fast cycle allows the gage to make use of high-speed electronic counting, marking and sorting devices. It also can be used with production analyzers and other accessory devices.

CARBIDE TOOL STUDY SHOWS INCREASED USE

A survey of industry's use of solid tungsten carbide, rotary cutting tools was recently released by the Carmet Div. of Allegheny Ludlum Steel Corp. which reported an increase of more than 500 percent in the past three years. The gain, the report says, was brought about primarily through new applications and new designs in the tools themselves—development of these tools has not reached its full potential.

Many rotary cutting tools mainly reamers and twist drills, that formerly were tipped with carbide now are being made of solid carbide. Tool manufacturers seem to find that solid carbide gives better over-all performance at lower cost for many applications, taking into consideration higher initial cost of solid carbide.

Among reasons cited in the survey for increased interest was (1) desire of tool manufacturers to get longer lasting tools with fewer sharpening or regrinds; (2) advanced techniques in powder metallurgy which make better cemented carbides available; (3) high degree of accuracy available in preformed solid carbide tool blanks; and (4) increased cost of diamond wheels and the labor to finish the nonpreformed carbide.

The survey indicated that size range for solid preformed carbide tools apparently is preferable in the $\frac{3}{16}$ to $\frac{3}{4}$-in. diameter range. Economics of producing these tools seems to show that it is less costly on tools less than $\frac{3}{16}$ in.

in diameter to grind the flutes from the solid. On tools larger than ¾ in. in diameter, most manufacturers use the conventional tipping method. However, beyond this size range, where high rigidity or high resistance to wear (in case of end mills) is required, solid carbide tools would be desirable.

Segment of the market in which Carmet is active is the preforming of the solid carbide cutting tools. In preforming, the almost finished tool design is machined into the carbide while it is still in the presintered or soft state, and then sintered in special furnaces.

ALUMINUM COATED STEEL PROVIDES EXTRA BENEFITS

Steel that is protected against corrosion with a special aluminum coating is now being utilized in manufacture of economical cable support systems by Chalfant Products Co. The material, which combines surface properties of aluminum with strength of steel, permits support of heavy cable loads and requires little maintenance throughout the extremities of cable travel.

Experiment indicates that the new Armco Aluminized steel, Type 2, withstands effects of corrosion, under normal industrial conditions more than three times longer than commercial zinc coated galvanized steel. After exposure tests conducted in an industrial atmosphere during a 17-year period, the aluminum coated steel was intact and still in useful condition.

At temperatures as high as 800 F the aluminized steel shows strength and rigidity.

BRITTLE METAL MACHINING SIMPLIFIED BY ULTRASONICS

Problems encountered in shaping and machining of ferrite and other hard, brittle metals seem to be overcome by ultrasonic techniques. At least it is through this method of machining that The Sheffield Corp.'s research division is solving difficult cutting jobs involving ferrite. A specific problem, for example, has been to cut a slot 0.0015 in. wide through the wall of a ferrite toroid for insertion of a 0.001-in. thick silver pickup. Such assemblies are used extensively in electronic controls, and the problem of machining hundreds of such slots at a time is currently under study.

Another ferrite application is machining of an irregular shape into another type of ferrite toroid to be used as a saturable reactor core. When machined on a jig bore using diamond wheels, the brittle ferrite loaded the wheels, causing breakage and scrap losses. The problem also involved critical tolerances. Sheffield's ultrasonic equipment, called Cavitron, proved successful because of its ability to use tools in the softened state.

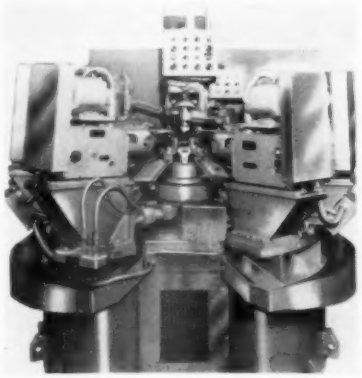
This Ferramic ring was produced by an ultrasonic machine tool.

Ultrasonics again proved successful for shaping hard, brittle materials when it was used as the tool for a production method for machining ferramic rings to required tolerances.

COMBINED UNITS CREATE SPECIAL MACHINE

Nine automatic cam feed units and an automatic indexing table have been combined by The Avey Div. of the Motch & Merryweather Machinery Co. to create an automatic piston smoke hole drilling machine.

After parts are loaded into the fixture, they are automatically clamped. One unit then drills one $\frac{3}{16}$-in. diam hole on 24 deg angle, four units drill

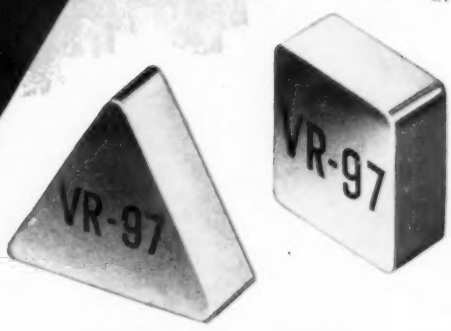


four $\frac{9}{64}$-in. diam holes on 2 deg angle, and four units drill four $\frac{9}{64}$-in. diam holes on 4 deg angle.

These operations complete, the table indexes 15 deg and the units drill the four remaining $\frac{9}{64}$-in. diam holes on 2 deg angle and three $\frac{9}{64}$-in. diam holes on 4 deg angle. The table again indexes, this time 180 deg, and the operations are repeated on the opposite side of the piston. Control of the drill units and their respective cycles are controlled by telephone stepping switches.

FOR ULTRA HIGH SPEED MACHINING

NEW CERAMIC VR-97



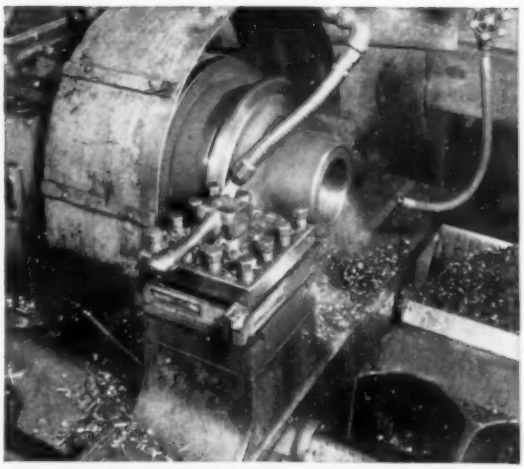
TRIANGULAR and SQUARE THROW-AWAY INSERTS for Negative Rake Toolholders

An Entirely New Aluminum Oxide Cutting Tool Material Made by a Completely New Process

- High purity ceramic material.
- Extremely fine microstructure.
- Consistently uniform.
- Higher strength and greater shock resistance.
- Resists heat, edge wear and abrasion.
- Cuts material in high hardness range.
- Tests have proved that VR-97 will produce more pieces per cutting edge.

SEND FOR NEW BULLETIN

Complete details, specifications and dimensions included in Bulletin No. 5710. Write for your copy or call your local V-R representative or distributor.



MANUFACTURERS OF: CEMENTED CARBIDES, TOOLHOLDERS, TANTUNG® CAST ALLOY CUTTING TOOLS and THROW AWAY FACE MILLING CUTTERS.

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SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

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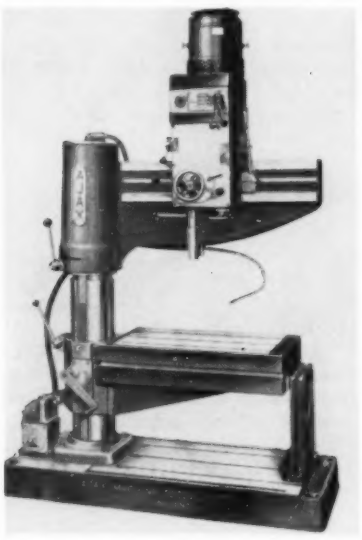
TOOLS of today

Drill Presses

Line of high speed automatic-cycling drill presses are designed so that spindle speeds, feed range, stroke, feed stroke and rapid approach are infinitely adjustable. Morris Air-Oil-Matic drill heads provide automatic cycling with fast approach and fast return for drilling or tapping and positive stop with



adjustable time delay for such operations as spot facing, counterboring, etc. The machines are furnished in single or multiple-spindle models.

Each spindle has an individual control station by which the type of operation is selected, then when the start button is pushed, the drill automatically goes through the selected cycle.

Adjustable speed drive provides infinitely adjustable spindle speeds with maximum spindle speed of 8000 rpm available on the standard machines. Seventeen different ranges of spindle speeds are available, and the speeds within the range are infinitely adjustable with a ratio of 7:1 maximum to minimum spindle speed.

Multiple feeds and rapid approaches are available through the use of special feed dogs.

Secrest Machine Co., 1507 M. St., N. W., Washington 5, D. C. **T-2-1**

Testing Machine

An air-operated stress-rupture and creep-testing machine assures convenient, uniform load application for indefinite periods. Indefinitely adjustable loads to 30,000 lb can be applied without shock and maintained regardless of normal fluctuations in line pressure. Load is indicated by either of two mercury column indicators: low range is 0-6000 lb, and high range is 0-30,000 lb.

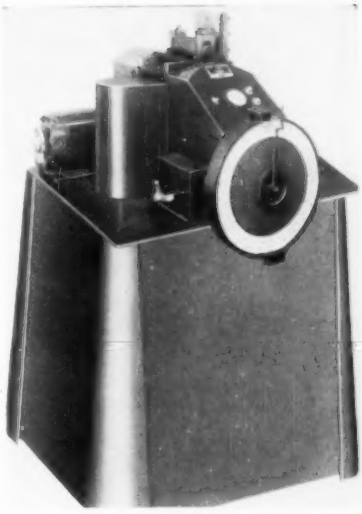
Specimen may be tested at any temperature from 0 to 1800 or 2000 F. Temperatures are automatically maintained by an electric furnace.

Tinius Olsen Testing Machine Co., 7479 Easton Road, Willow Grove, Pa. **T-2-2**

Cutoff Machine

Designed to handle either wire or flat stock, the metered, automatic cutoff machine will repeatedly cut material to any length from 2 in. through 30 ft. Machine capacity will service six wires of 0.065 by up to 3 in. wide at the rate of 60 fpm. Tolerance of cut lengths on shorter lengths is $\pm\frac{1}{64}$ in.; intermediate lengths is $\pm\frac{1}{32}$ in. and longest lengths is $\pm\frac{1}{16}$ in.

Operation involves pushing the "On and Off" switch and setting the metered



length requirement on the dial. The simple metering device allows an operator to set the length range for a specific job. A counter stops the machine after the required number of pieces have been produced.

The machine may be operated as a unit or may be used in conjunction with existing reel, roll feed, straightener or other equipment.

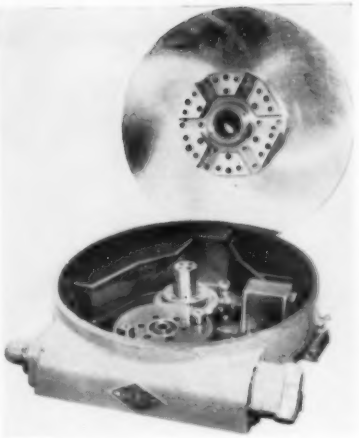
Durant Tool Supply Co., 1-15 Thurbers Ave., Providence, R. I. **T-2-3**

Index Table

GEM-26 model dial index table, 26 in. in diameter, will index a weight of up to 2000 lb and may be equipped with as many as 12 stations.

The table will index to ± 0.001 in. on a 24-in. work circle with true Geneva motion. Workpieces are positioned smoothly in as little as $\frac{2}{3}$ sec.

Rotary air motor, solenoid valve, and



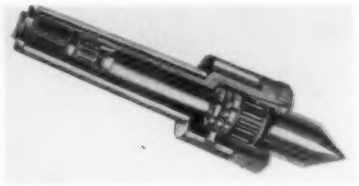
limit switch are standard equipment with the table; electric and hydraulic motors also are available. In setup and maintenance operations, the extended shaft can be turned manually without air or electric power.

Gray Equipment Co., 13600 Ford Rd., Dearborn, Mich. **T-2-4**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Live Centers

Precision frictionless live centers are designed to have a life expectancy of practically 10,000 working hours. By employing ball and roller bearings, radial and lateral thrusts are sustained,



avoiding wear and damage. Runout is held within 0.0001 in total indicator reading. Oiling is required only once a year.

George Scherr Co., Inc., 200 Lafayette St., New York 12, N. Y. **T-2-5**

Spiral Flute Reamer

Standard length solid carbide chucking reamer (with steel shank) featuring right hand spiral flutes are available in diameters from ⅛ to ¾ in., overall lengths from 3½ to 9½ in. There are 4 flutes in fractional sizes ⅛ through ¼ in.; 6 flutes on reamers from 9/32 through ¾ in.

Features of this spiral-fluted reamer include its straight shank for full chucking, brazed solid carbide cutting

tip, radius chamfer and right hand cutting.

Tolerances of the 17 tools in this Series 1565-R are: diameters up to and including ¼ in. plus 0.0002, minus 0.0000; 9/32 to ½ in. inclusive, plus

0.0003 to minus 0.0000; 9/16 to ¾ in. inclusive, plus 0.0004 to minus 0.0000. Shank diameter tolerance, all sizes, is plus 0.0005, minus 0.0005.

The Atrax Co., 240 Day St., Newington, Conn. **T-2-6**

Welding Machine

Automatic welding machine, capable of welding collars on each end of a tube at the rate of 360 welds an hour, requires an operator only to load and unload the parts used.

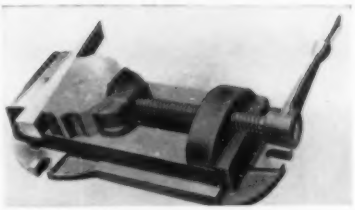
The welding unit is a General Electric of inert arc type, using 0.045-in. diam. electrode at 72 ipm. It can also

be used as a multiple-station indexing plate. With interchangeable fixtures several different operations can be accomplished with the basic machine.

Tri-City Tool & Machinery Corp., P. O. Box 404, Rock Island, Ill. **T-2-7**

Turret Jaw Vise

Capable of clamping workpieces of any shape with a positive grip on at least 4 points, the All-Purpose rotary turret jaw vise uses no special inserts or attachments. Vises are available in machine and bench type models with jaw openings from 2 to 8 inches. They are designed to insure quick, accurate set ups and may be applied for through drilling and tapping as no vise spindle obstructs the way of



the workpiece. By use of the locking pin, the tool also may be operated as a parallel vise, yet the turret jaw may be rotated to any position of recesses provided.

Hudson Automatic Machine & Tool Co., 137-139 Thirty-eight St., Union City, N. J. **T-2-8**

Parting Compound

A Nicrobraz material, called White Stop-Off, acts as a parting compound to prevent the brazing of mating surfaces during furnace brazing operations. The material, supplied in powder form, is mixed with a volatile plastic, called Nicrobraz cement, to facilitate application.

It may be applied by brushing, dipping or spraying. Residue following brazing is easily removed by air-blasting or brushing.

Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich. **T-2-9**

Tool Grinders

Two models have been added to the Ex-Cell-O line of off-hand tool grinders. Both of the double-end, reciprocating type, they are Style 142 for conventional grinding with vitrified or diamond wheels, and Style 264 equipped with metal-bonded diamond wheels for electrolytic grinding.

They are designed to perform two jobs in one: conventional grinding at one end and chip breaker grinding at the other. Because of adjustable, pow-

er-controlled reciprocation of the grinding wheels, the operator only needs to hold the tool at the preset angle. A vertically adjusted table, accommodates an adjustable tool block fixture which holds the tool in place while grinding the desired angle on the chip breaker groove.

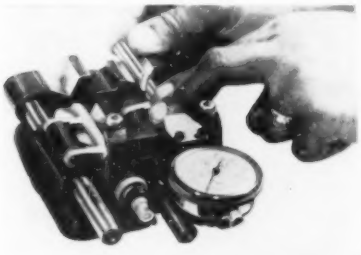
The grinder has adjustable stroke of 0 to 1½ in.; adjustable reciprocation of 0 to 220 strokes per minute; and a built-in motorized precision grinding spindle, saddle-mounted to reciprocate along hardened-and-ground bars.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. **T-2-10**

Drill Point Checker

The Matrix drill point measuring instrument is constructed so that two vees support either a straight or tapered shank drill; centrality is checked on the dial indicator to 0.001 in.

The tool is available in a ¼ to ¾ in. size and in a ¾ to 2½ in. size. Operation is simple, fast, and requires



no previous training; setting standards are supplied for standard drill point angles.

Distributed in U. S. by Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. **T-2-11**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Ultrasonic Cleaner

A one-gallon portable ultrasonic cleaning unit for hard-to-clean objects and intricately assembled parts, utilizes sound waves, that are propelled into the cleaning solution to create a powerful scrubbing action. In addition to cleaning, the unit is effective for degreasing, decontamination, removal of excess flux, mixing, and emulsifying.

The unit consists of a generator that features a built-in timer, turning knob and visual control, and produces an output of 50 watts average with a peak of 200 watts; and a stainless steel one-gallon tank equipped with three transducers capable of handling production

jobs on a continuous basis. No special installation or wiring is required; it needs only be plugged in and turned on.

Hermes Sonic, 13-19 University Place, New York 3, N. Y. **T-2-12**

Cylindrical Grinding Attachment

An accurate cylindrical OD dual-purpose grinding attachment uses true dead centers which assure concentricity to 0.0001 total indicator reading. It also is designed to serve as an inspection instrument.

When used on grinding operations the attachment is set directly on either the magnetic chuck or table of the surface grinder. When the attachment is to be used as an inspection fixture

it is set on the surface plate.

A built-in sine plate and micrometer permit grinding and inspection of tapers within seconds of an arc, spring loaded tail stock centers also contribute to accuracy, and a micrometer range from plus 0.025 to minus 0.025 eliminates need for gage blocks. An index

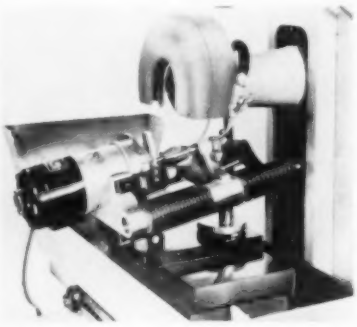


plate permits work to be indexed within seconds of an arc and has 24 divisions.

All moving parts are adequately protected from water, coolant, grit and dust, etc. No disassembly is required for cleaning.

Gebhart Machine Tools, Ltd., 1608 Victory Blvd., Glendale, Calif.

T-12-13

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Portable Marking Unit

The Marking Cruiser, 24 x 36 x 32 in. high, contains items necessary for hand stamping and provides both the tools and the working area for such operation. The unit contains a retractable stool, two hammers, absorber pad, a lamp mounted over the font case and

working anvil for easy sighting. Rubber-tired casters are retractable to permit stability when the unit is in use.

The font case contains 4 sizes of hand stamps; 1/16, 3/32, 1/8 and 3/16 in. of 40 characters each.

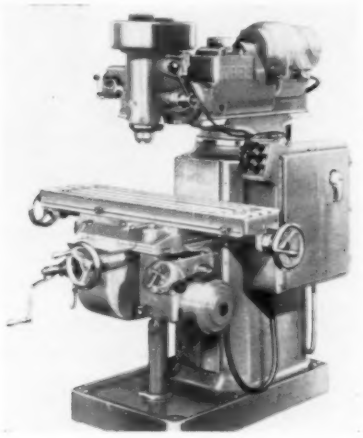
Geo. T. Schmidt, Inc., 4100 Ravenswood Ave., Chicago 13, Ill. **T-2-14**

Vertical Milling Machine

A geared-in-ram vertical milling machine, designated the 2 VG mill, will handle cutters up to 4 in. in diameter. The quill is driven by a 3 hp motor mounted on the ram.

Feature of the mill is an automatic collet closer for holding cutters in position and preventing tool slippage. It holds tools up to 1 in. diameter shank size. A roller spindle drive prevents backlash, and a turret lock operates with a single motion.

Twelve speeds range from 50 to 2500 rpm; there are 6 geared changes in ram



gear box, and high and low range selection on head. Neutral position on head is for rotating spindle by hand. There is 6 in. quill travel by hand feed lever, hand wheel or power feed. The three dial-selected rates are 0.001, 0.0025, and 0.006 in. ipr. Feeds are both up and down. Ram construction permits moving spindle to be moved to any position without the resetting for alignment.

Tree Tool and Die Works, 1600 Junction Ave., Racine, Wis. **T-2-15**

Thread Rolling Machine

Model 125A Planetary thread rolling machine rolls screws, bolts and nails at speeds of 600 to 800 pieces per minute. It handles overall blank stock lengths up to 3 in. and diameters from 4 to 5/16 in. for thread rolling, roll forming, knurling, marking, serrating and necking.

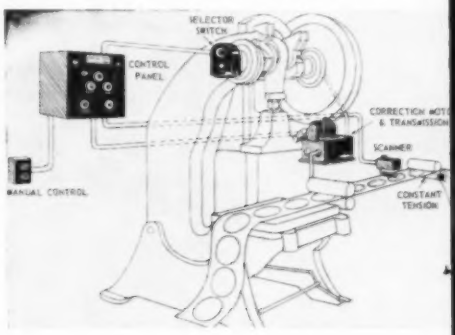
Construction permits rear loading

during production. A cradled hopper has external drive free of obstructions. End-mounted vibrator provides peak efficiency. The machine has rapid adjusting feed rail width; a micrometer feed-rail positioner; expanding die mandrel for trueing die; and thinwall ring die that can be set up in 10 min. to perfect concentricity.

Prutton Corp., 5293 W. 130th St., Cleveland 30, Ohio. **T-2-16**

Electronic Control

A photoelectric scanner in conjunction with a selector switch is used in presses and in other stamping applications to detect errors and transmit the information to a correction motor. The motor operates a correction



transmission which makes the necessary mechanical adjustment.

The controls enable the container manufacturer, for example, to form his container from a prelithographed or preprinted continuous roll of raw material.

Machine O'Matic, Inc., 2045 N. Hoyne Ave., Dept. #43, Chicago 47, Ill. **T-2-17**

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Toolmakers' Microscope

Inspection and measurement of both small tools and work parts can be made on a toolmakers' microscope manufactured by Bausch & Lomb.

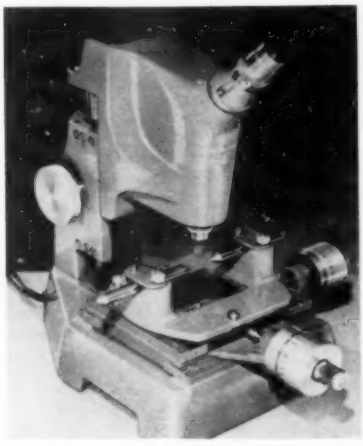
Total range of magnification with interchangeable eyepiece and objective lenses is 27X to 360X. Standard lenses supplied give a magnification of 35X. The eyepiece is conveniently angled for comfortable use over extended periods. A knurled ring on the eyepiece permits sharp focusing on the cross lines. A simple screw adjustment aligns the cross lines to a position exactly parallel with stage movement.

Working distance is 4 in., permitting focus on parts or tools up to 2½ in. in

depth. Vertical illuminating system, which is an integral part of the instrument, prevents shadows.

Measurement is possible in two directions, controlled by micrometer spindles reading directly to 0.0001 in. Total range of stage movement is 1 x 2 in.

Optional accessories include an interchangeable protractor eyepiece to permit accurate measurement of angles; a

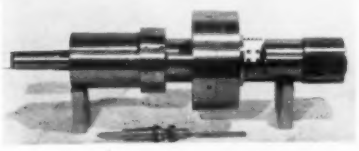


center support with centers, easily attached to the cross slide stage, to allow the measurement of cylindrical objects; and special eyepiece scales, made to customer specifications to fit specific applications.

Sold by the DoAll Co., Des Plaines, Ill. **T-2-18**

Recessing Tools

Tooling originally developed for machining the breech block mechanism in atomic reactors may be applied to any large workpiece requiring internal forming and milling operations. Complete tooling consists of a recessing tool, which machines the internal annular grooves, and a milling attach-



ment, which mills the longitudinal slots to receive the male breech mechanism.

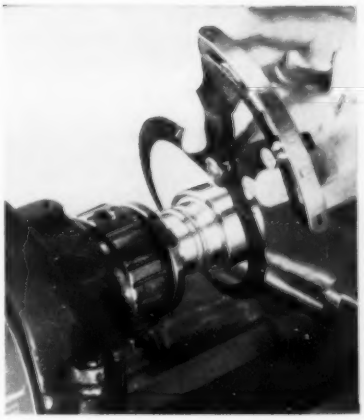
Both tools are designed for use in radial drills, boring mills, milling machines, etc. Speed of operation results in considerable economy.

Size of the recessing tool can be judged by the standard recessing tool shown below it.

Maxwell Industries, Inc. Macedonia, Ohio. **T-2-19**

Direct-Reading Caliper

Bar or sheet stock, and lathe turnings up to 4 in. thick as well as irregularly shaped castings and mouldings can be measured with the direct-reading caliper. Squeezing the handle opens the caliper; a spring closes it gently on the work. Size is then read directly on a 0-to-4 in., black-on-white scale that is precisely calibrated in inches by 32nd's. Long, curved legs reach over flanges and other obstructions to measure the thickness of sections up to 3 in. in from the edge of a part. Narrow tips on the legs penetrate to the bottom of slots and grooves only 1/16 in. wide. Tightening of a thumbscrew locks the caliper



at any measurement for use as a gage.

The caliper illustrated is Model 1404 for outside measuring; a companion inside caliper (Model 1405) is also available.

Master Specialty Co., Inc., 3725 Monitor Ave., Minneapolis 26, Minn. **T-2-20**

Lathes

A line of lathes, designated Powershift Preselector lathes, are available in ratings of 1610 (13 in.), 2013 (16 in.) and 2013-17 (20 in.) in engine, toolmaker, gap models and in 45 and 90 deg. Copymatic tracer-controlled types.

On these machines, the operator can preselect the next speed while the tool is cutting; can minimize tool wear,

tool changing and tool cost by using the correct cut speed for each diameter; and can correct cut speed to produce a finish that requires little subsequent finishing operations.

Headstock of the lathe has a single dial. Inner portion of the dial is stationary and is graduated in inches of diameter (of the workpiece or cut); Outer position of the dial is graduated in feet per minute, surface speed. Setting one against the other instantly computes spindle rpm, showing this figure together with maximum safe horsepower.

This simple operation preselects the cutting speed. After the selection is made, automatic shifting of gears is controlled by the operator from his position at the carriage. With a convenient lever, he can "start", "stop" or "shift".

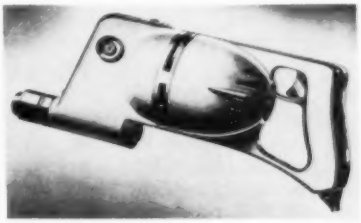
In addition to preselecting speed, the operator can setup as many as six additional cutting speeds on the selector dial. Sequentially numbered tabs can be used to mark dial settings for the other speeds.

Shifting of the gears on the headstock is accomplished by an electrohydraulic mechanism. A hydraulic oscillator jiggles the gears to assure positive, damage free shifting. Headstock design is such that electronic programming can be added to provide preselection of any number of speeds.

The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio **T-2-21**

Electric Hammer

An electric hammer which weighs only 8½ lb has a cushion snap. Although it provides a heavy impact, it



is designed so there is no direct vibration or recoil.

Modern Mfg. Co., Inc., 680 Davisville Rd., Willow Grove, Pa. **T-2-22**

Portable Transfer Feed

Straight side presses can be converted to automatic transfer feed drive operation by means of a self-contained transfer feed console.

Basically an automation device, the accessory also can be used to move material through a series of presses. It is operated through one power takeoff from the press crank, or may be independently powered and set up to control the press cycle. No special mounting provisions are required on the press frame.

In operation, aluminum feed rails

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-2-17	American Drill Bushing Co.	Drill Bushings—New catalog lists complete line of drill bushings. (Page 17)
A-2-15	The American Tool Works Co.	Lathes—American 32-inch, double-carriage Pacemaker lathe described in Bulletin No. 144. (Page 15)
A-2-182	Armstrong-Blum Mfg. Co.	Hack Saws—Marvel catalog gives details on metal-cutting saws. (Page 182)
A-2-220-1	Automation Devices, Inc. Vibratory Feeder Co., Div.	Feeders—Parts Feeding equipment information described in "VFC" Feeding Data Book. (Page 220)
A-2-55	The Bellows Co.	Air Motors—Bulletin BM-25 describes the complete packaged air-cylinder power unit with built-in controls. (Page 55)
A-2-14	The Blanchard Machine Co.	Grinding Machines—Third edition of the book "The Art of Blanchard Surface Grinding" is now available. (Page 14)
A-2-201	Brown & Sharpe Mfg. Co.	Cutting Tools—Over 2300 high-speed steel tools and accessories described in new 96-page catalog. (Page 201)
A-2-264-3	Cawi Machine Co., Inc.	Grinders—Special bulletin gives full details and description of Cawi W & H tool and cutter grinder. (Page 264)
A-2-159	Chicago Rivet & Machine Co.	Rivets—Standard tubular and split rivets described in catalog. (Page 159)
A-2-221	The Cincinnati Milling Co.	Heat Processing—Flame-treating equipment described in Flamatic Bulletin M-2015 and induction heating described in Induction Bulletin M-1993. (Page 221)
A-2-240	The Cincinnati Shaper Co.	Press Brake Construction—Catalog B-5 discusses press brake. (Page 240)
A-2-193	Circular Tool Co., Inc.	Circular Saws—Catalog O describes the various types of circular saws. (Page 193)
A-2-220-2	Cleveland Instrument Co.	Height Gages—Bulletin describes Indi-Ac indicating height gage. (Page 220)
A-2-34	Crane Packing Co.	Lapping Machines—Booklets are available containing the complete facts on producing and measuring precision flatness and finish. (Page 34)
A-2-224-4	Dayton Rogers Mfg. Co.	Die Cushions—Catalog describes die cushions. (Page 224)
A-2-188-51*	Eclipse Counterbore Co.	Counterbores—Engineering data contained in catalog No. 51. (Page 188)
A-2-188-56**	Eclipse Counterbore Co.	End Mills—Engineering specifications described in catalog No. 56. (Page 188)
A-2-243	Edlund Machinery Co. Div. Harsco Corp.	Drilling and Tapping—Model 2F production drilling and tapping machine described in Bulletin 140R. (Page 243)
A-2-213	Ehrhardt Tool and Machine Co.	Gages and Dies—Facilities available illustrated in brochure. (Page 213)
A-2-252-2	Fiske Bros. Refining Co.	Lubricant—Bulletins describing Fiske's "Magic" compound and other specialty lubricants and coolants. (Page 252)
A-2-216-4	M. A. Ford Co., Inc.	Countersinks—HSS and carbide countersinks described in Bulletin 702. (Page 216)
A-2-208	The Gaertner Scientific Corp.	Optical Measurement—Bulletin 147-56 describes toolmakers' microscopes. (Page 208)
A-2-48	Gardner-Denver Co.	Air Tools—Booklet gives complete information about Keller screwdrivers and nutsetters. (Page 48)
A-2-8	Gisholt Machine Co.	Lathes—Advance data on the new Gisholt master line Fastermatic Automatic Turret lathe described in Bulletin No. 1179. (Page 8)
A-2-244	George Gorton Machine Co.	Tracer Mill—Complete information on hydraulic tracer control duplicators in Bulletin 2711-2602. (Page 244)
A-2-186	Greenlee Bros. & Co.	Automatics—Catalog A-405 contains information on Greenlee automatic bar machines. (Page 186)
A-2-246	Handy & Harman	Brazing—Bulletin 20 contains the values, techniques and economies of low-temperature silver alloy. (Page 246)
A-2-54	Cutter Division The Ingersoll Milling Machine Co.	Cutting Tools—Catalog 66F describes the complete line of inserted blade milling and boring tools. (Page 54)
A-2-202	The B. Jahn Mfg. Co.	Dies—Twenty-page brochure contains case histories and engineering specifications of progressive dies made by B. Jahn. (Page 202)
A-2-205	Jarvis Corp.	Taps—Catalog contains listings of all standard tap sizes and styles plus tap engineering data. (Page 205)

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-2-204	Lepel High Frequency Laboratories, Inc.	Induction Heating—Illustrated catalog of induction heating data. (Page 204)
A-2-166	Melin Tool Co., Inc.	End Mills—Catalog No. 54-C lists specifications on stub length tools. (Page 166)
A-2-200	Micrometrical Mfg. Co.	Profilometer—Bulletin LT17 contains details on Profilometer Group II. (Page 200)
A-2-261	The National Acme Co.	Thread Rolling—Applications of thread rolling heads and rolls shown in Catalog NAF-57. (Page 261)
A-2-214	Nelco Tool Co., Inc.	Milling Cutters—New catalog shows over 700 carbide-tipped tools. (Page 214)
A-2-215	Oakite Products, Inc.	Metal Cleaning—Engineering application described in booklets for power washers and the field of organic finishes. (Page 215)
A-2-224-3	Opto-Metric Tools, Inc.	Microscopes—Catalog 81/159 describes Leitz microscope. (Page 224)
A-2-162-1	Ortman-Miller Machine Co.	Hydraulic Cylinders—Descriptive drawings of cylinders, mounting accessories and capacity chart given in Bulletin 105. (Page 162)
A-2-238-4	Precision Tool & Mfg. Co. of Illinois	Boring Tools—Deka-Bore boring heads and bars are described in a new catalog. (Page 238)
A-2-58	The Producto Machine Co.	Die Sets—Catalog No. 11 describes die sets and die accessories. (Page 58)
A-2-190	Ring Punch & Die, Inc.	Punch and Dies—Illustrated Catalog 195 describes punches. (Page 190)
A-2-184	Rockford Clutch Div. Borg-Warner	Clutches—Bulletin shows typical installations of clutches and power take-offs and diagrams of unique applications and engineering data. (Page 184)
A-2-230	Rotor Tool Co.	Grinders—Bulletin 56 contains data on vertical grinders. (Page 230)
A-2-181	Coromant Div. Sandvik Steel, Inc.	Carbide Tools—A complete Coromant line of carbide tools, blanks and inserts, and cutters with technical data is contained in catalog. (Page 181)
A-2-49	Simonds Abrasive Co.	Grinding Wheels—SA Borolon wheels are described in Bulletin ESA 272. (Page 49)
A-2-183	The S-P Mfg. Corp.	Chucks—Self-centering and compensating chucks are described in Catalog No. 105. (Page 183)
A-2-256	Unbrako Socket Screw Div. Standard Pressed Steel Co.	Screw Threads—Sixteen-page brochure, Form 2294, discusses lead error and thread tolerances. (Page 256)
A-2-59	The L. S. Starrett Co.	Dial Indicators—Catalog contains information on a complete line of Starrett dial indicators and dial gages. (Page 59)
A-2-282	Sundstrand Machine Tool Co.	Milling Machine—Bulletin 788 describes Sundstrand C-Model Rigidmils. (Page 282)
A-2-25	Sunnen Products Co.	Honing—Five informative booklets are available on honing and typical applications case studies. (Page 25)
A-2-223	The Timken Roller Bearing Co. Steel and Tube Div.	Steels—Timken Graphitic Steel Book describes uses of graphitic tool steels in dies, punches, gages and machine parts. (Page 223)
A-2-267-3	Tinius Olsen Testing Machine Co.	Balancing—Electro-dynamic machines described in Bulletin 58. (Page 267)
A-2-160	The Tomkins-Johnson Co.	Cutters—Catalog No. 1057 contains information on range of styles and sizes of T-J's die-sinking cutters. (Page 160)
A-2-18	Uddeholm Company of America, Inc.	Steels—Tool Steel Stock List No. 12 available. (Page 18)
A-2-38	United States Drill Head Co.	Drill Heads—Catalog AD-57 describes U S Drill heads. (Page 38)
A-2-10	U. S. Tool Co., Inc.	Roll Feeds—Full information on Style "B" roll feeds available in Bulletin 85-T. (Page 10)
A-2-227	Universal Engineering Co.	Drill Bushings—Standard drill bushings, chucks and toolholders described in catalog. (Page 227)
A-2-156	Vascoloy-Ramet Corp.	Cutting Tools—Details, specifications and dimensions of ceramic cutting tools included in Bulletin No. 5710. (Page 156)
A-2-219	Waldes-Kohinoor, Inc.	Grooving Tool—Full information on Waldes Truarc grooving tool contained in 20-page manual. (Page 219)
A-2-269	Whitman & Barnes	Drills and Reamers—Product information and literature on drills and reamers available. (Page 269)

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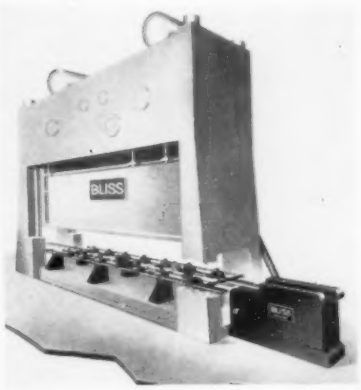
are driven from right to left, and may be used to push or pull work through the press. Transfer fingers, attached to pivoted arms or rack and pinion fingers on the feed rail, are actuated through linkage to the same drive source as the rails. Finger motion can be adjusted for "straight" or "lifting" operation.

Feed stroke is adjustable from 15 to 30 in. in increments of 1 in., and



the light feed rails can be moved without disturbing die settings.

Dies can be serviced without interference by rails, fingers, etc.

In the event of a misfeed, interlocks in each finger stop the press and feed; other interlocks prevent the rails from moving while the fingers are feeding.

E. W. Bliss Co., Canton, Ohio. **T-2-23**

Lubricant

A grease lubricant called Grezall PI is soluble in water, alcohol and esters, and insoluble in petroleum products and in chlorinated solvents. Such characteristics make it suitable for applications where any of these solvents are used. It is useful, for example, as a lubricant for solvent pumps.

Above 400 F, the lubricant melts.

Tower Oil Co., 300 West Washington St., Chicago 6, Ill. **T-2-24**

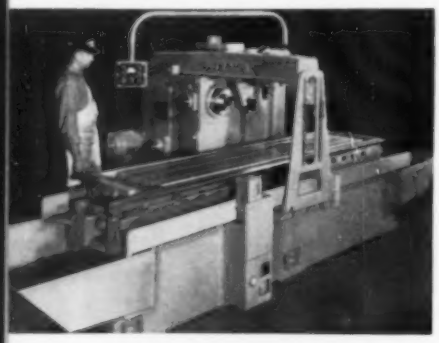
Milling Machines

Available in both simplex and duplex designs, C Model Rigidmill milling machines are designed for unit construction of head, table, and column to permit these basic elements to be interchanged through several machine sizes. Machines can be customized to provide proper combination of table size, stroke, spindle speeds, and horsepower.

The machines are available with spindle motors ranging from 7½ to 75 hp, table widths from 14 to 38 in., and table strokes from 3 to 14 ft. Pushbutton control permits small-lot milling, while

automatic control by dogs on the front of the machine allows a variety of table cycles for production milling.

Mechanical drive to table feed screw has a 100:1 ratio between high and low feed rates. Standard feed range is from ¾ to 75 in., with 1½ to 150 ipm as optional extra. Three spindle speed



ranges are available in each model machine except in machines rated from 60 to 75 hp, where a high-speed range normally is not required.

Sundstrand Machine Tool Co., Rockford, Ill. **T-2-25**

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Cutting Tools

Matched holder and cutter shank design of this line of special cutting tools assures strength and rigidity for accurate alignment. Based on the

clutch drive principle, a special Taper-Torque drive provides high load-carrying capacity. Strong, on-center drive lugs provide a more equal distribution of the radial driving force between holder and tool. This design also affords rigidity which minimizes tool chatter and permits a smooth flow of power, even on rough, interrupted surfaces. Rigidity also helps prevent contact shock from backlash or slack.

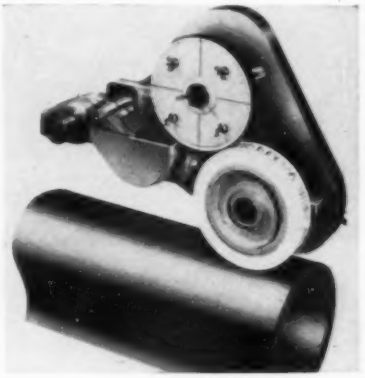
Taper design of the tool shank assures accurate positioning and alignment of the tool in the holder without exerting any driving force on it. Power is transmitted through the on-center drive lugs. There are no internal machined sections, springs, lugs, or balls inside the holder to require maintenance. A cam-type drift tool facilitates removal of tools from the holder.

Five sizes of holders will accommodate cutters from ¾ through 3⅜-in. OD. They are available in any grade of high-speed tool steel and can be tipped with carbide.

Metal Cutting Tools, Inc., 301 S. Water St., Rockford, Ill. **T-2-26**

Lineal Printer

The No. 248 offset printer provides continuous, lineal printing at speeds as high as 1000 fpm on steel, aluminum or plastic pipe, bars, tubing or other like products. Mounted directly over a moving production line, the unit is ca-



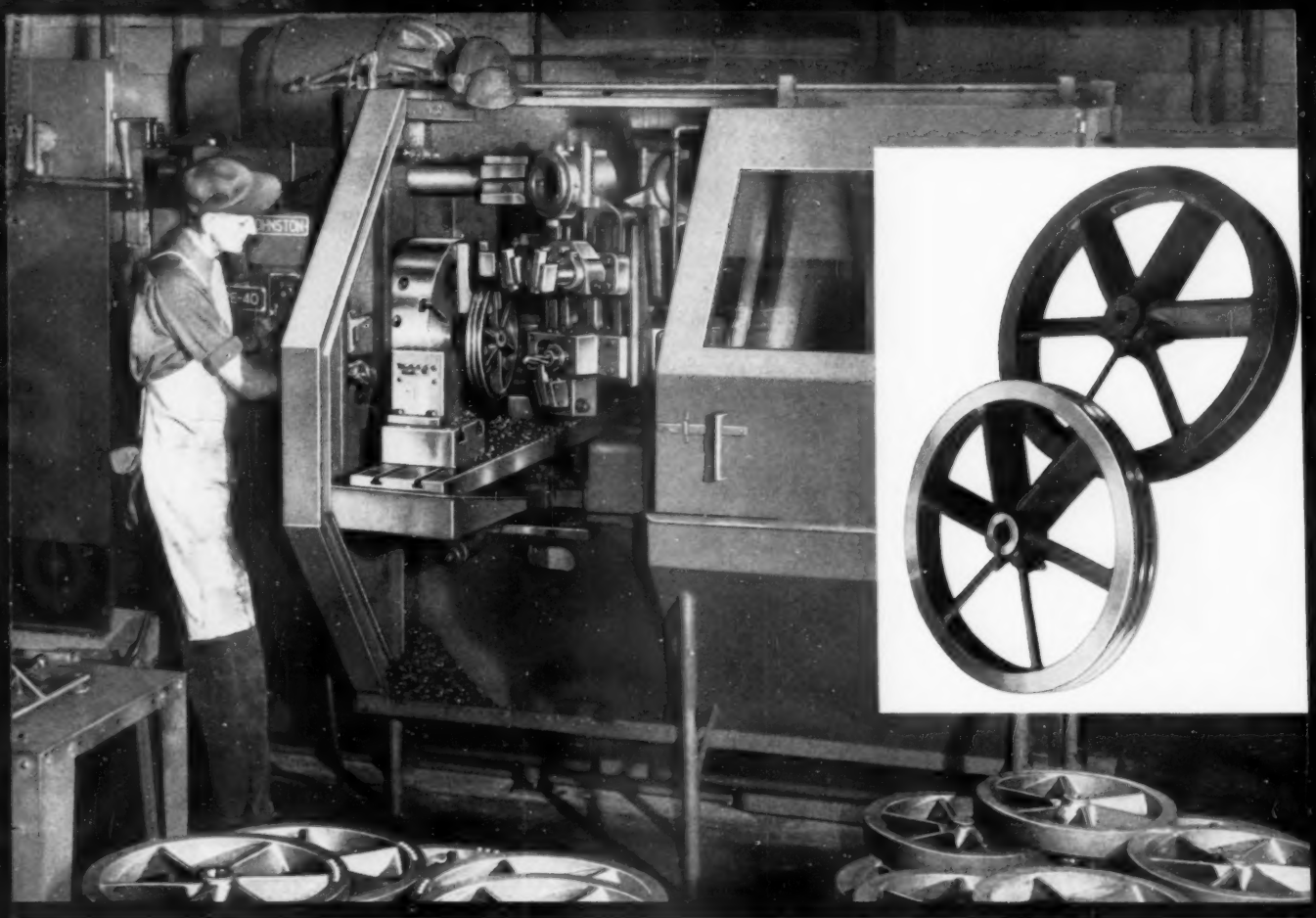
pable of printing on an unlimited range of product sizes from ½ in. OD.

The offset printing feature permits the use of larger character sizes than are previously practical because the rubber printing roll readily conforms to the radius of the material being marked. Two sizes of type wheels are available.

Jas. H. Matthews Co., 3923 Forbes St., Pittsburgh 13, Pa. **T-2-27**

Air Press

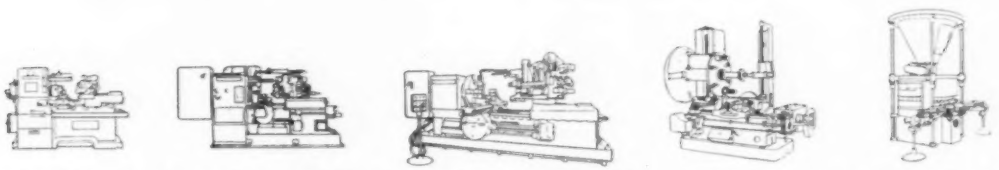
Light-duty bench air press, Model 491, was designed primarily for marking operations, but it is also useful for light staking, dimpling, punching, bending, and related operations. It has a one-ton capacity and a ram stroke adjustable from 0 to 1 in. Mounted and keyed to a vertical post, the head can be readily adjusted up and down without losing position. The head features a diaphragm type air cylinder which does not require filtered or lubricated air. A three-way



. . . SAVE 66% IN LABOR COSTS through "JOB INTEGRATION"

The Potter & Johnston 6DRE-40 Automatic Turret Lathe recently installed at the Toledo, Ohio plant of the DeVilbiss Company machines large, high-precision flywheels – handling 5 complex cuts on a fully automatic basis. Previously, using a hand-type lathe, this same job required 5 separate hand operations and the operator's full-time attention. Now, with the P&J *Automatic* on the job, the operator also handles two secondary operations . . . keyway broaching and balancing . . . that formerly required 2 additional operators working in separate departments. As a result of this new "job integration," labor costs have been reduced 66% with 2 men released for other work, overall time for flywheel production has been reduced 20 to 30%, and costly time-wasting intra-plant handling has been eliminated.

If your manufacturing operations demand high-speed, economical production of precision parts, a switch to P&J Automatics can help reduce machining time and costs . . . and may also make it possible to streamline a whole series of related operations. Act today. Let us send the P&J Representative in your area to analyze your requirements and recommend a production plan to meet your needs. Write direct to Potter & Johnston Company, Pawtucket, Rhode Island



AUTOMATIC TURRET LATHES . . . GEAR CUTTERS . . . PACKAGING MACHINES

POTTER & JOHNSTON

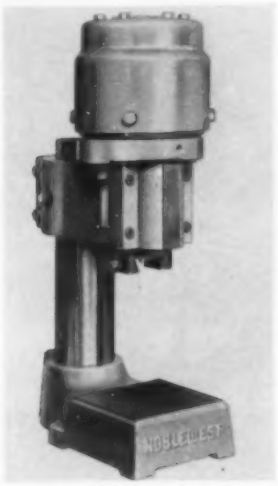
SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.

PRECISION PRODUCTION TOOLING SINCE 1898

air valve operates the press.

The rectanguar press ram has a dovetail slot to accommodate the standard tool holder. This slot also provides a means for front-to-back adjustment and facilitates quick removal of the tool holder from the press.

Height of the machine is 22½ in., width 6½ in., depth 12 in., weight 85



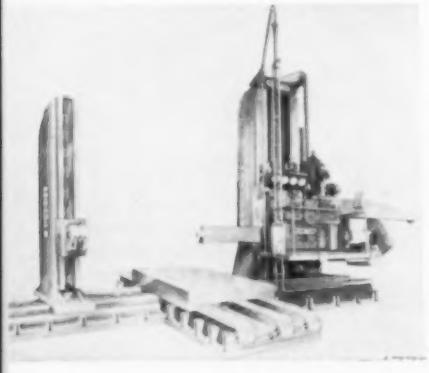
lb. Reach from center line of dovetail to column is 3½ in., gap, from underside of dovetail to base is 7 in., bed width is 5⅛ in., and bed depth 5⅛ in., column diameter is 3 in., stroke is 1 in.

The Noble & Westbrook Mfg. Co., East Hartford, Conn. **T-2-28**

Boring and Milling Machines

Line of heavy-duty horizontal boring and milling machines incorporate square rams. Rotating spindle moves horizontally with the square ram as one unit, providing both strength and accuracy to the ram's maximum extension. The square ram also allows working in restricted areas without interference.

The line includes Model B and Model BC floor type boring and milling machines, and Model P and Model PC (illustrated) planer type boring and milling machines. Models BC and PC have column cross travel. All four models are available in a square-ram size range of 9 to 14 in. with an enclosed spindle size range of 6 to 10 in. A smaller series, with an 8-in. square ram and 5 in. spindle diameter, is offered in the Model LB floor type and Model LP planer type machines.



The combination of rotating spindle and square ram, with the ram as a rigid member, allows accessory applications without need for accessory supports.

Morton Mfg. Co., Broadway and Hoyt, Muskegon Heights, Mich. **T-2-29**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Carbide Twist Drills

Designed for drilling various types of nonmetallic and nonferrous materials, a line of carbide-tipped and solid-carbide twist drills are now available from stock in all the popular styles and sizes.

They also perform on many cast iron applications and on some steels

where chip forming conditions are satisfactory.

In brittle and abrasive materials the carbide drills will permit high cutting speeds and, because of the high wear resistance of carbides, will have long life.

National Twist Drill & Tool Co., Rochester, Mich. **T-2-30**

Tilting Work Table

Heavy-duty worktable for radial drilling, tapping, and boring permits both angular and radial positioning of workpieces, and provides 360 deg rotation and eight equally spaced radial locating holes. Cradle-type design of the table permits tilting work in a number of different planes, from horizontal to vertical.

The table consists of a heavy saddle equipped with 3-in. pivot pins. The standard table is 20 in. square x 3 in. thick. Underside of table has eight equally spaced precision-bored positioning holes for radial location.

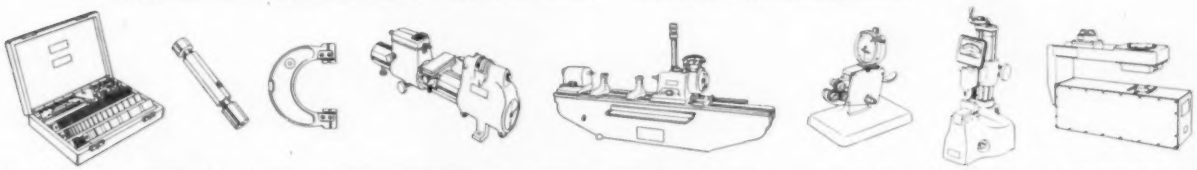
The table and cradle are accurately located in angular and radial positions by means of spring-loaded, hardened steel indexing pins which are lever-operated through rack and pinion

CUMMINS CUTS INSPECTION TIME 33%...

. . . and Pratt & Whitney Gages can bring *you* similar savings! One of the world's largest manufacturers of high-speed diesels the Cummins Engine Company believes that finer precision is a matter of increased production and greater profits. Gaging the depth of cylinder liner counterbores in cylinder blocks, Cummins was using a mechanical depth gage . . . checking at 2 points in each bore. To improve speed and precision on this vital inspection, Cummins switched to a P&W 3-Station Air-O-Limit Comparator. Inserted into the bore, the gage head checks depth at 3 points simultaneously . . . and a twist of the wrist provides readings around the entire circumference. Gaging time has been cut 33% with inspection costs correspondingly reduced. More accurate readings are obtained. And the full 360° inspection provides an extra assurance of product precision.

Because precision is important at Cummins, there are dozens of P&W Gages of every type in this plant. As their gage foreman states, "We like their accuracy and dependability – and the excellent service provided by the Pratt & Whitney Company."

You too can put greater precision to work to cut costs and increase production. Write now for more complete information on Pratt & Whitney Gages. Pratt & Whitney Company Inc., 10 Charter Oak Blvd., West Hartford, Conn.



GAGE BLOCKS . . . CONVENTIONAL GAGES . . . SUPERMICROMETERS . . . STANDARD MEASURING MACHINES . . . COMPARATORS . . . AUTOMATION AND CONTINUOUS GAGES

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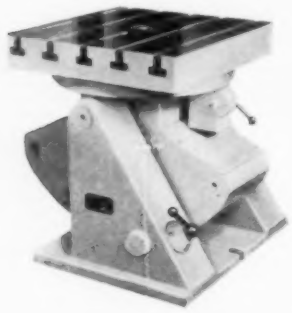
gears. The cradle is equipped with removable cover and inside bosses which carry counterweights. Extra space is provided for additional counterweights as may be required to suit specific work.

Opposite side of the saddle housing also is equipped with an auxiliary friction-type locking pin which is lever-operated in the same manner as the indexing pins. This permits positioning the table at intermediate planes.

Provision for using an interchangeable worktable indexing plant for specific work is included in the table



design. These can be provided to suit a broad range of specific hole patterns. Degree spacing of indexing holes in the saddle also can be provided to better serve specific needs.

Galger Engineering and Mfg. Co., 3802 S. Main St., Rockford, Ill. **T-2-31**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Expansion Reamer

Carbide-tipped expansion machine reamer incorporates a patented method of expansion which assures rigidity comparable with that of a solid-body reamer.

Expansion, to compensate for wear, can be accurately controlled, and is uni-

form throughout the length of the cutting blades.

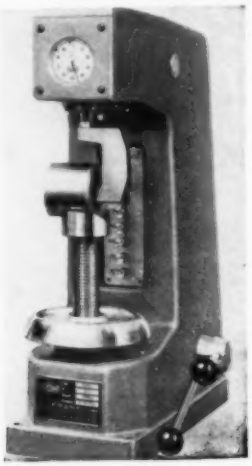
The cutting element can be replaced by removing a worn-out shell and installing a new one.

Several styles and a range of sizes are available.

Staples Tool Co., 1407 Fisher Bldg., Detroit 2, Mich. **T-2-32**

Universal Hardness Tester

A universal type of hardness tester made in West Germany is designed so that eight different loads can be selected by pushbutton control. In this way a choice of several tests is presented in one machine: Rockwell C by "Brale" penetrator, Rockwell B by 1/16-in. steel ball, Brinell by 2.5, 5



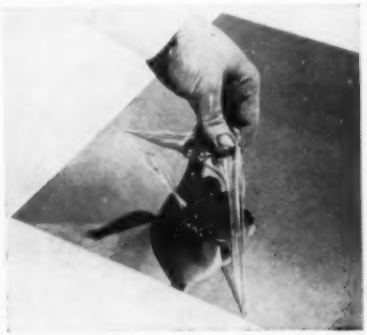
and 10 mm steel balls, and Vickers by 136 deg. diamond penetrator.

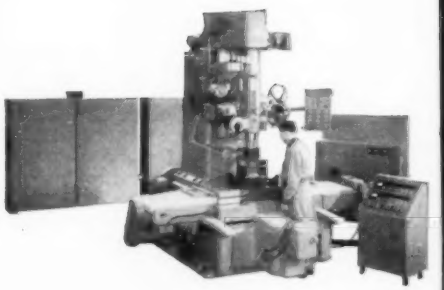
All operating parts are fully enclosed. The dial gage provides automatic zeroing for the minor load. An oil brake permits load speed regulation and two coaxial ball handles insure maximum operating speed.

Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y. **T-2-33**

Protective Coatings for Metals

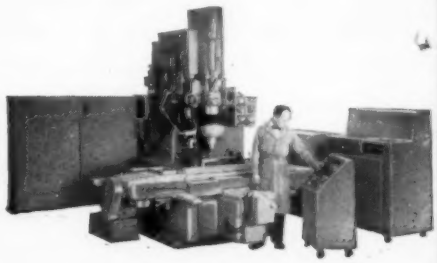
Severe drawing and forming operations that have been considered impossible to achieve with prefinished metals can be satisfactorily produced with prefinished Nickeloid metals protected with Mar-Not. This protective coating permits Nickeloid metals to meet unusually severe fabricating and handling conditions without harming

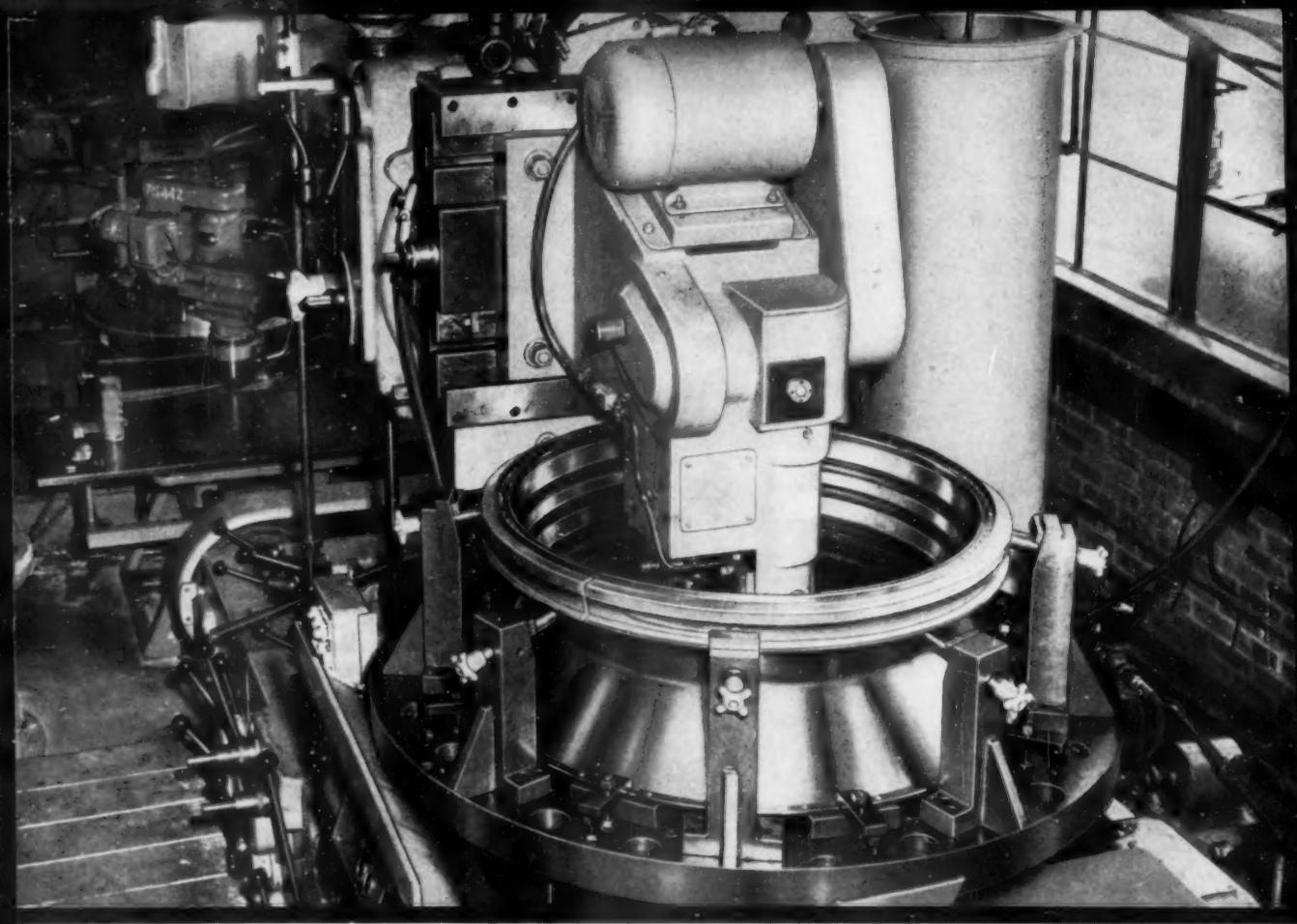




OTHER P&W NUMERICALLY CONTROLLED MACHINE TOOLS

. . . include the Electrolimit Jig Borer and the Vertical Precision Hole Grinder.





NO MISTAKES with NUMERICAL CONTROL

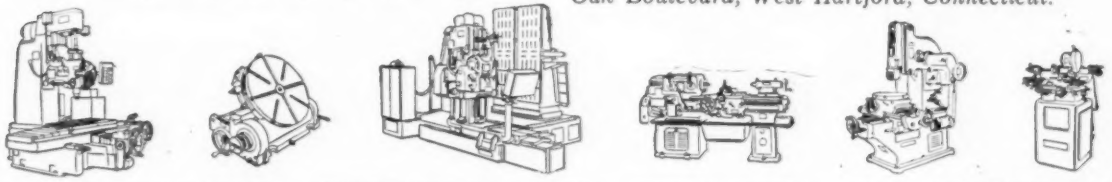
. . . and Machine Time Cut 46%!

These were the results when a Pratt & Whitney Numerically Controlled Rotary Table was put to work by Lycoming Division of AVCO Manufacturing Corporation. This job involves milling 236 slots accurately located on three rings within jet engine cases. Directed by a punched tape, the new table automatically indexes the work for each cut. Indexing is accurate to 5 seconds of arc. In addition, the table's numerical control system governs the milling feed motions . . . putting the entire operation on an automatic cycle.

Replacing a hand-indexing rotary table, the P&W Numerically Controlled Rotary Table has cut machining time 46%! Equally important, P&W Numerical Control eliminates operator error in locating the 236 slots . . . which would turn a nearly completed workpiece into scrap.

Lycoming's experience is no isolated example. Applied to P&W Rotary Tables, Jig Borers and other machines, Pratt & Whitney Numerical Control is producing equally spectacular time-and-money savings in many other plants. It may well offer opportunities for greater profits in *your* plant.

Write now for complete information. Pratt & Whitney Company, Incorporated, 16 Charter Oak Boulevard, West Hartford, Connecticut.



JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

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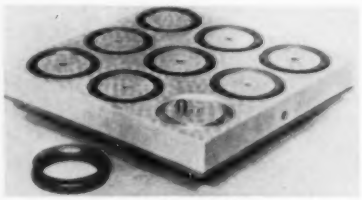
the plated finish. It is available in two forms: Type M is a pressure-sensitive paper which is adhered to the metal by a special adhesive; Type C is a stripping type plastic film which stretches as the metal is formed. When finished, Mar-Not M can be easily peeled off; and Type C can be either peeled off or blown off with compressed air.

American Nickeloid Co., Peru, Ill. **T-2-34**

Vacuum Chuck

A universal multiple-grip vacuum chuck, called the Octopus, will handle almost any size or shape of work. Any one or any combination of vacuum apertures can be sealed off, confining the gripping area to the work at hand. Any piece of material which covers one of the small rubber sealing rings can be worked on, while multiple suction grips provide stability during machining for large size materials. Designed



and patented by Convair Division of General Dynamics Corp., the vacuum chucks are made from 921-T cast aluminum tooling plate on special order in specified sizes. A magnetic chuck may be converted for working nonmagnetic materials by superimposing the Octopus vacuum chuck fitted with a steel base plate.

Engineering Advisory Service, Pioneer Aluminum Inc., 5251 West Imperial Hwy., Los Angeles 45, Calif. **T-2-35**

Core Drier

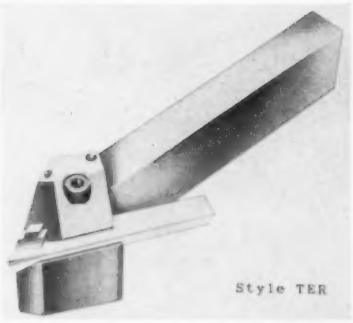
Hysol HF 1385 casting epoxy, developed especially for use in dielectric core drying ovens by Lebanon Steel Foundries and Houghton Laboratories, is inexpensive and easy to cast and use.

Houghton Laboratories, Inc., Olean, N. Y. **T-2-36**

Carbide Tool-holder

Designed for engine lathe toolroom and production use, this carbide tool-holder affords positive rake, positive center and positive chip control. The solid carbide chipbreaker is infinitely adjustable; thus accommodates any combination of feeds and depths of cut.

The heat treated alloy steel tool-holder utilizes a solid carbide triangu-



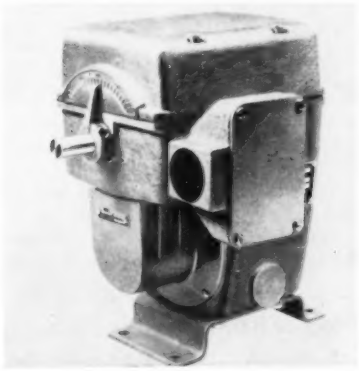
lar toolbit, positioned in the holder for positive rake turning; permitting greater depths of cut with decreased tool pressures and up to 30 percent horsepower reduction over negative rake tools. End of shank is relieved to clear lathe center.

The holder, available in two different styles, also has up to 2-in. reduction on the diameter in one pass; any nose radius is available to suit machining requirements and optimum finish.

Everede Tool Co., 2000 N. Parkside Ave., Chicago 39, Ill. **T-2-37**

Electric Motor

Valves, dampers and other controlled devices can be operated in accordance with signals generated by electric control instruments by this electric motor. Two models, each having two-position, floating or proportional control forms, are available in various speeds and torques. Series 831E2 has



a rated output torque ranging from 1.5 to 31.2 ft-lb; Series 831E1 torque rating ranges from 3.1 to 62.5 ft-lb. Stall torques for both series are a minimum of twice the rated torques.

The motor will accurately position final control elements over full drive shaft rotation. Two-position and floating control models can be adjusted for 35 to 335 deg rotation and the proportional model for 35 to 100 deg rotation without loss of reversing ro-

tation. An external relay permits the floating model to be made unidirectional, or arranged for reversing, for more than one complete revolution of the output shaft.

"Coasting" of the motor is negligible; over-travel protection is provided for the proportioning slidewire contactor so that disengagement takes place if travel limits are exceeded.

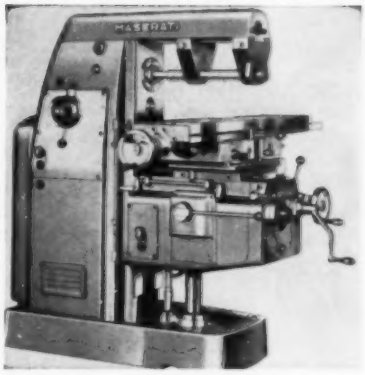
Double-rated loads cannot drive the motor through gear trains. An arc suppression circuit incorporated into the internal wiring protects switches and relay contacts. Voltage and frequency of the motor are 115 or 230 volts 50 or 60 cycles, or 115 volts 25 cycles.

Minneapolis-Honeywell Regulator Co., Brown Instruments Div., 7th & Grange Sts., Philadelphia 44, Pa. **T-2-38**

Milling Machine

First of a series of milling machines, Model NU1, has a 47 x 11½ in. table, a 4-hp single-speed motor for the spindle, and a separate 1.5 hp motor flanged to the knee, for table and knee power feeds (longitudinal, cross and vertical), and for the rapid traverse, in all directions. Spindle motor and knee motor are independently controlled by a single long lever on the left hand side of the machine. When this lever is pushed down both motors are started unless a disconnect switch on the control panel has disconnected the knee motor. The entire machine (motors, reverse, brake, electric pump) is controlled from an electric panel located on the front of the machine.

The spindle has two ranges of 12 spindle speeds (either from 36 to 1500 rpm or from 43 to 1800 rpm.) An electro-magnetic brake provides for instantaneous stop of the spindle. The spindle speed selection dial has a push button for intermittent control of the motor to make the meshing of the gears easier.



Maserati Corp. of America, 46 Sea Cliff Ave., Glen Cove, L. I. **T-2-39**

Combination Drill and Countersink

A hole can be drilled and countersunk in one operation with a high-speed steel combination drill and countersink. The tool, available in both plain and bell type points is designed with spiral flute. Included angle of

plain type is 60 deg. and the bell type is 120 deg.

Smooth accurate holes are produced by this tool: production is fast because of chip removal and free cutting action. Diameter of drill portion equals length of drill.

The tool is available in sets and in size diameter from 3/64 through 14 in.

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. **T-2-40**

Production Micrometer

A precision, motor-driven production micrometer can handle up to 10,000 spherical pieces per hour, as well as rectangles, squares, tapers and other shapes. Designated the Roller Mike, the unit is designed to sort and measure small-to-miniature parts, for precise classification, by thickness, in production quantities or small lots, and with total tolerances down to 0.000030 in. It will operate continuously with minimum attention.

Units can be placed in series with each succeeding machine offering fur-

ther sorting refinement. Automatic feeds can be furnished to provide an unattended operation, and provisions can be made for sorted parts to be fed into a continuing process.

The portable, self-contained device has eighteen collecting bins. With an adjustment difference of 0.001 between the roller ends, a theoretical sorting by

groups of 0.000050 in. with good consistency can be achieved.

It will not mar fragile parts because the upward-outward rotation of the unit's rollers causes such pieces to travel by their own weight and drop only about an inch into the sorting bin.

Affiliated Manufacturers Inc., 60 E. 42nd St., New York 17, N. Y. **T-2-41**

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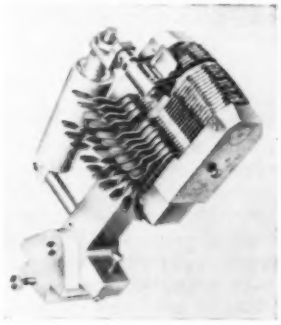
Numbering Head

Model 484 automatic numbering head has a barrel-shaped wheel assembly to permit roll-marking a 20-digit number into flat workpieces with



a permanent indented impression in a curved line.

Basically automatic in operation, the device is designed to index after each roll-marking stroke to give consecutive serial numbering. In place of a cam or lever arrangement for indexing, a small 1⅛-in. bore air cylinder operates directly from the mark-

ing machine cycle.

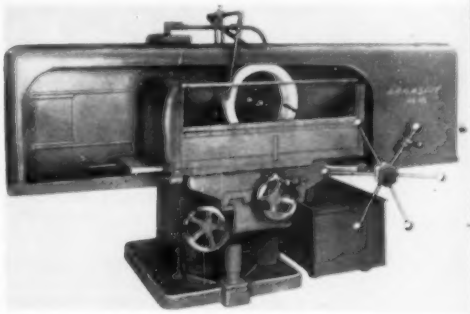
The head is equipped with a total of twenty indexing levers, in two banks, for manual indexing of all wheels including those wheels which are also indexed automatically by the air tripper.

Engraving on each wheel is off center so that the roll-marking impression is on a curve or radius.

The Noble & Westbrook Co., East Hartford, Conn. **T-2-42**

Face Grinder

An 18 in. face grinder, which incorporates power feed to the table, has a hydraulic power system with 2 hp, 1200 rpm motor to provide the equivalent of a 50-lb push at the handwheel, which amounts to 600 lb at the table. Maximum cutting speed is 25 fpm and the return is 42 fpm. The power unit is interlocked with the table handwheel as a safety measure.



The machine removes metal accurately and quickly on flat surfaces and gives a grinding finish. It has a 15 hp, 900 rpm heavy duty motorized spindle.

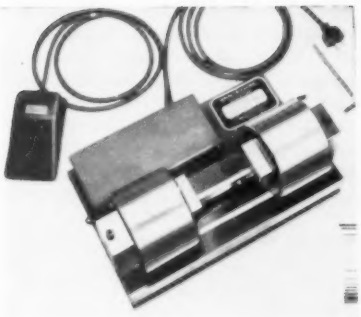
Abrasive Machine Tool Co., East Providence, R. I. **T-2-43**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Self-Contained Magnetizer

Light duty Model MF-200 and medium duty Model MF-300 self-contained magnetizers, which can be plugged into any 115 v a-c outlet, combine magnetizing coils and silicon rectifier in one unit. No permanent, rigid installation is needed. The small, light units may be used with all permanent magnet alloys. The magnetizers are planned with reserve capacity for use with possible future, more powerful magnetic materials.

MF-200 magnetizer (rated at 10,000 amp turns with 2.5 amp current demand at 115 v) is used to magnetize Alnico 5 magnets up to 1½ in. long (or up to 2-sq. in cross-sectional area). The unit is 9 in. wide, 14 in. long and 6¾ in.



high and weighs 45 lb.

The MF-300 magnetizer measured 14 in wide, 24 in. long and 8 in. high, and weighs 150 lb. It magnetizes magnets up to 8 in. long (or up to 7 sq in. cross-sectional area), and is rated at 50,000 amp turns with 30 amp current demand at 115 v a-c (or 15 amp at 230 v a-c).

General Electric Co., Magnetic Material Section, Edmore, Mich. **T-2-44**

Machine Bases

Line of standard machine bases which come knock-down, are made of steel plate ranging from 3/16 to 5/16 in. in thickness. Parts are so designed that any size of base from 24 to 48 in. in length or width and from 24 to 54 in.

in height may be quickly assembled. The parts are drilled so that they can be bolted together for welding.

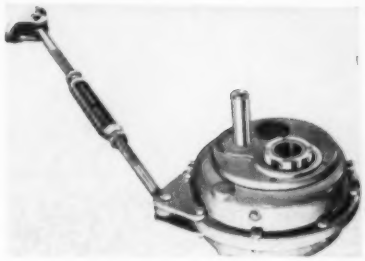
The bases are available immediately as stock items. They can be used repeatedly by simply making changes in tooling.

Inter-Lakes Engineering Co., 39200 Groesbeck Hwy., Mt. Clemens, Mich. **T-2-45**

Gear Reducer

A shaft-mounted gear reducer eliminates need for motor bases, rails, supporting structures and flexible couplings. It also assures alignment, and makes possible infinite speed ratios through the use of adjustable-speed pulleys or by changing sheaves, sprockets or prime mover speed. Belt tension between drive and driven unit is maintained by adjustment of a rod and turnbuckle.

Eighteen models, including single and double reduction types, can be supplied from stock. Single reduction types are 98 percent efficient and afford 4.5:1 speed ratio (nominal). Double reduction types are 96 percent efficient and afford 14.7:1 speed ratio (nomi-



nal). Horsepowers range from fractional to 120; output speeds from 8 to 425 rpm.

The reducer is installed direct to driven shaft and can be mounted vertically of at any angle. Hollow shaft bores range from 1 7/16 to 5 15/16 in., with bushings available to accommodate slightly undersize driven shafts. Slightly oversize driven shafts can be necked down or can be accommodated in the same manner as undersize by using a larger reducer.

Torque reaction brackets can be furnished for units with platform-mounted or reversing drives.

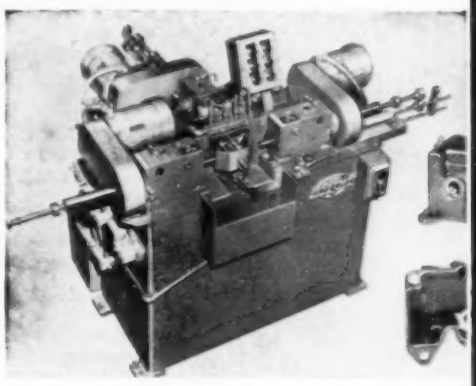
Lovejoy Flexible Coupling Co., 4978 W. Lake St., Chicago 44, Ill. **T-2-46**

Boring Machine for Aluminum Die Castings

Three-station precision boring machine for machining aluminum die castings consists of three standard Model S-6 Hydro-Borers mounted on a steel base. Two of the boring units are equipped with air-operated, rapid-approach arrangement, designed to quickly advance the boring spindle to the workpiece. The part is manually loaded into a stationary fixture and the three holes are bored simultaneously.

Right and left hand units are equipped with combination boring heads which face, counterbore, and bore two side holes in alignment with each other. The rear unit bores and faces the internal hole in relation to the two side holes. The parts are loaded, machined, and unloaded in a cycle time of 30 seconds.

Other features are an automatic operating cycle, push-button control for retraction of boring spindles at any point during rapid approach or machining cycle, and individual control at each station for tool setting, adequate coolant and chip disposal. A hydraulic pump is not required, because of the special feed principle.



Greenlee Bros. & Co., Rockford, Ill. **T-2-47**

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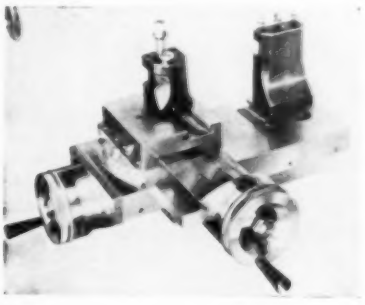
Slide Rest

Swivel slide of this Super slide rest is graduated in degrees so that it may be swung and used for turning operations on the lathe, without interference between handles or slides.

Design incorporates a center-driven toolpost slide and an open side toolpost to provide maximum ease of operation.



Top slide travel in 4½ in.; tool bit size is ⅜ x ⅜ in.; large dials are both direct reading in thousandths of an inch and are resettable to zero.

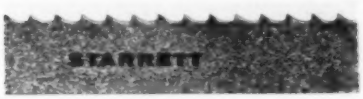
The Wade Tool Co., 49 River St., Waltham 54, Mass. **T-2-48**

Band Saw Blades

A hard-edge, flexible-back band saw blade has positive rake hook teeth which cut with a smooth shearing action that requires less feed pressure than conventional blades.

The teeth are designed for uniform stress distribution to permit heavier feeds for fast cutting. Rounded gullet construction insures efficient chip flow and greater chip removal without clogging.

The blade is particularly suitable for fast, low-cost cutting of nonferrous

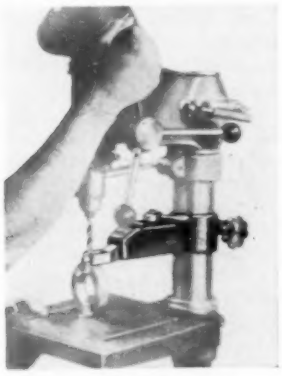


metals, special composition, fiber, plastics, wood and similar materials. It is available in welded bands to fit any band saw machine and in 100, 250 or 500-ft. coils.

The L. S. Starrett Co., Athol, Mass. **T-2-49**

Work Holder for Drill Presses

A convenient and efficient device called the Sta-Put, is designed for use with drill presses. Split collar of the device permits it to be attached easily to a drill press column, where it can be

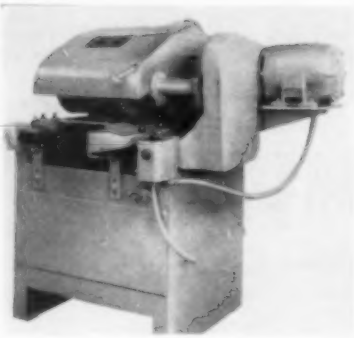


quickly adjusted to hold any shaped piece securely in desired alignment with drill. The device is available with either a wheel or lever handle.

Cincinnati Tool Co., Cincinnati 12, Ohio. **T-2-50**

Belt Sander

Compact design, size and 34-in. feeding height make the Speedbelt 12-in. abrasive-belt machine practical for use in production lines where small metal parts are fed to it by conveyor directly for deburring, polishing or finishing operations. Used in tandem, deburring and



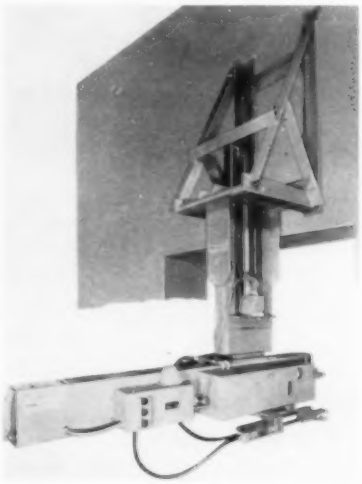
polishing can be done in sequence by utilizing two different grit sizes of abrasive belts. In sanding operations, flat stock can be handled directly from the molder to speed up production. The machine is available with 3 types of feed tables. Positive feed adjustment can be made quickly for any type material up to 2 in. thick. For jobs requiring a wider belt the machine also is available as a Speedbelt 18 model.

Timersaver Sanders, P. O. Box 7446, Robbinsdale Station, Minneapolis 22, Minn. **T-2-51**

Press Unloading Unit

Unit for unloading stampings from presses in a straight line consists of an overhead arm having a built-in vertical slide adjustment, standard air-powered straight-line press unloader and a standard mechanical jaw assembly.

The arm bolts to mounting pads on the crown of presses. Vertical adjustment of the unloader can be made at floor level, and it can be raised verti-



cally a sufficient distance to clear the press working area for die setting operations. The equipment has a total vertical travel adjustment of up to 42 in. It can also be swung in a horizontal plan to a position parallel to the press frame to avoid crane chain interference during die setting. A variety of standard PAS straight line press unloaders as well as jaw assemblies can be mounted on the unloader to meet various unloading requirements.

Press Automation Systems, Inc., 25418 Ryan Rd., Centerline, Mich. **T-2-52**

Lathes

The 5400-series 12¾-in. general-purpose lathes incorporate a quick-change mechanism for instant selection of 54 threads or feeds—27 are obtained merely by shifting two levers on the gear box, and an additional 27 by shifting the position of a sliding gear.

Variable-speed countershaft makes any speed from 35 to 270 rpm and 210 to 1600 rpm immediately available while the lathe is running. Speeds are changed by turning handwheel on front of lathe cabinet. Clutch and brake, controlled by lever on lathe cabinet, permit instant starts and stops of lathe spindle without stopping motor—clutch is multiple disc, dry operating.

The 5400-series lathes also are avail-

able with ten-speed ball bearing countershaft that provides speeds between 35 and 1600 rpm. Three V-belts power the lathe spindle.

The lathe has $12\frac{3}{4}$-in. swing over bed, $7\frac{3}{8}$ in. over cross slide; 23, 35 and $48\frac{1}{2}$ in. centers. Tailstock is No. 3 MT. Headstock spindle is forged steel with $1\frac{3}{8}$ in. bore, 1 1/16 in. lever type collet capacity, hardened nose.

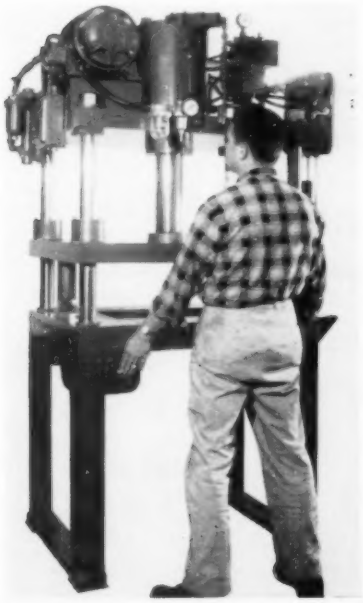
Clausing Div., Atlas Press Co., 26114 North Pitcher St., Kalamazoo, Mich. **T-2-53**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hydraulic Presses

Series of heavy-duty, fast-acting, high-velocity, hydraulic trim presses incorporate an accumulator with a closed, shock-free, pressurized, hydraulic system. Rapid cycling action is achieved with low horsepower input. Approach speeds range up to 2000 ipm ram travel.

They are available in platen sizes of 15 x 18 up to 36 x 54 in., offering 12, 15 and 18-in. strokes, with shut-heights of 5, 10 and 15 in., in 13, 20, 30, 40 and 50 ton capacities, in either 2 or 4 post types.

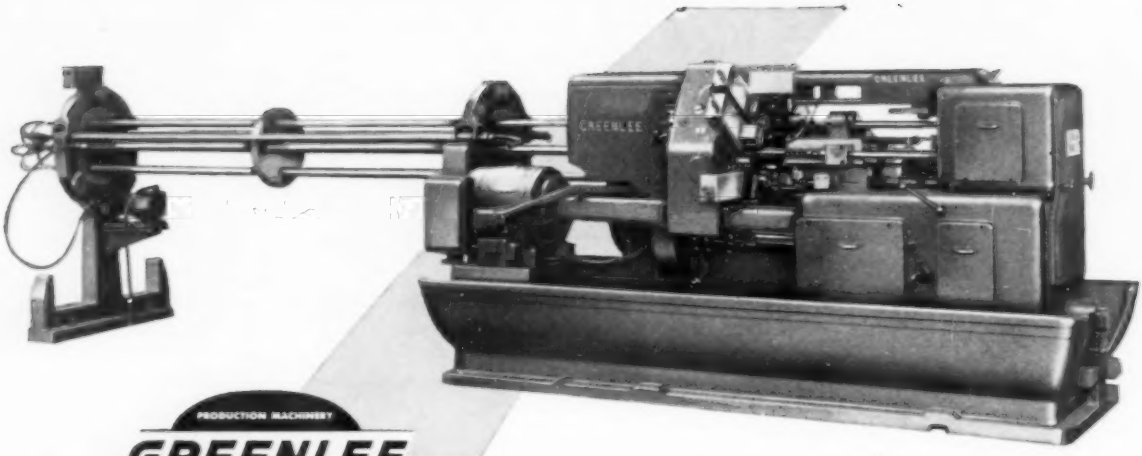


They require minimum space as all components including the motor, pump and reservoir are mounted on the top platen. The entire area beneath, behind and on all sides is free of equipment; this permits use of conveyors, chutes or other means of handling parts. Area below the platen affords room for the mounting of die cushions.

The full tonnage can be set to engage and disengage at any point in the stroke. Damage to dies or the press caused by misalignment of parts is impossible. Length of stroke can be adjusted for the needs of the job and can be shortened to any two points within the total stroke.

An electrical selector control permits selection of manual, semiautomatic and setup cycling. Operation can be as fast or as slow as the operator necessitates. Pressure is applied and released quickly without shock.

Bausenbach Hydraulics Div., Buffalo Metal Container Corp., 75 Meadow Rd., Buffalo 16, N. Y. **T-2-54**



PRODUCTION MACHINERY

GREENLEE

AIR-FEED AUTOMATIC

- **1 Permits Greater Job Versatility**
- **2 Easily Adapted to Multiple Feedouts**
- **3 Provides Longer Stock Feedout**
- **4 Eliminates Stock Scoring**
- **5 Reduces Stock Reel Noise**
- **6 Eliminates Stock Pushers**
- **7 Eliminates Feedout Cams**

Write today for Catalog A-405, or better still, have the Greenlee man call and show you the way to more profitable production with this air-feed automatic bar machine.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

GREENLEE BROS. & CO.

PRODUCTION MACHINERY

GREENLEE

1982 MASON AVE.
Rockford, Illinois

J. R. Barefoot is new president of The Federal Machine and Welder Co. replacing **A. S. Blagden** who was elected to the newly created post of chairman of the board of directors. Mr. Barefoot has been a vice-president for the past six years.

President of The Carpenter Steel Co., **Frank R. Palmer**, has been named to serve as president of the recently acquired subsidiary, Carpenter Steel of New England, Inc. Other officers for the new addition include: **John Moxon**, executive vice-president; **Arlington A. Britton, Jr.**, vice-president-production; **H. Sturgis Potter**, vice-president-sales; and **Carl B. Post**, vice-president and technical director.

John J. Morrissey was named general manager of General Drop Forge Corp., wholly owned subsidiary of Dana Corp. For the past five years he has been assistant chief industrial engineer at Wyman Gordon Co.

Paul Zoffmann is now technical director of Sam Tour & Co., Inc. and its affiliate, The American Standards Testing Bureau Inc., where he will supervise chemical and metallurgical laboratories and coordinate the chemical and metallurgical activities of the two organizations.

Three executive promotions were recently announced at C. A. Norgren Co. **Edward H. Roos**, who was made vice-president in charge of engineering, production and purchasing. **Richard L. Beach**, who was formerly assistant to executive vice-president, succeeds Mr. Roos as factory manager. **James S. Maches**, who has been working in Norgren engineering and manufacturing, was made plant superintendent, a new position in the firm. Mr. Roos belongs to ASTE's Denver chapter.

The board of directors of Southworth Machine Co. have made several administrative changes. **Stuart W. Tisdale**, formerly with Fibreglass Corp., was elected president of Southworth. **George F. Thurber, Jr.** and **H. Theodore Hawkes** were made vice-presidents. **Robert D. Brace** became secretary and **John W. Jackson** was named treasurer. In addition, **Thomas S. Dyer** was appointed production manager and **Gordon Braum** was named shop superintendent.

Formerly assistant to the general sales manager of Pratt & Whitney Co., Inc., **Clinton E. Smith** now is administrative sales manager for the company's machinery, cutting tool and gage divisions.

Electro Refractories & Abrasives Corp. announced the election of **Carl F. Leitten** as president and chief executive officer, succeeding **Grant S. Diamond** who was made chairman of the board. Both executives began their careers in research capacities with the company more than 30 years ago. Mr. Leitten also was elected president of Electro Refractories & Abrasives Corp. Ltd., a subsidiary.

Four staff appointments have been made for the metallurgical and operating departments of The Carpenter Steel Co.'s recently acquired subsidiary, Carpenter Steel of New England, Inc. **Walter A. Schlegel** is resident chief metallurgist; **Elmer Schwartz** is general superintendent of the production departments; **James MacMinn** is superintendent of billet preparation; and **Joseph J. Barrett** is assistant superintendent of hot rolling.

Latrobe Steel Co. has announced appointment of **Howard M. Givens** to the post of vice-president-sales to succeed J. E. Workman who was made executive vice-president. **W. G. Dahl** was named to fill Mr. Givens' former position of general sales manager. Mr. Dahl is a member of ASTE's Springfield, Mass. chapter.

Zeke R. Smith was elected vice-president of Potter & Brumfield, Inc., and will be in charge of all product and applications engineering for the company's three plants.

Edward H. Fisher has been named president of Tube Reducing Corp. Until recently he was vice-president and manager of Special Products Div. at the Oliver Corp.

R. L. Fairbank was elected president of The Material Handling Institute, Inc. at the organization's recent annual meeting. He is vice-president of Towmotor Corp.

J. E. Workman, who previously was vice-president-sales of Latrobe Steel Co., has been named to fill the newly created position of executive vice-president.

At Houdaille Industries, Inc., **Daniel J. Kennedy,** formerly Buffalo Hydraulics Div. factory manager, became assistant general manager of the Wales Strippit Co. unit of Houdaille. **W. L. Buckenhizer,** manager of Houdaille's Detroit Div. plant, was elected vice-president-manufacturing of Houdaille Industries Ltd. at Oshawa, Ontario.

Crucible Steel Co. of America has appointed **Kenneth A. Matticks** to fill the newly created post of manager of product development-stainless steel sales division. He has been a stainless contact metallurgist in the central metallurgical office.

At National Automatic Tool Co., Inc., **John R. Keates** has been made general sales manager of the Machine Tool Div. He has been a regional sales manager of Natco since 1943.

Walter W. Goehring was made manager of the manufacturing department of F. J. Stokes Corp. He previously was manager of manufacturing for the Can Div. of Crown Cork & Seal Co., Inc.

Fred Y. Walters, Jr. was appointed manager of F. J. Stokes Co. of Canada, Ltd., a subsidiary of F. J. Stokes Corp. He has been associated with the Canadian firm since January 1955.

William R. Johnson is chief research metallurgist and **Richard J. McCluskey** is chief machine design and development engineer at Associated Spring Corp's research center in Bristol, Conn. Mr. Johnson has been research metallurgist at the firm's Wallace Barnes Co. division since August 1953. Mr. McCluskey joins the organization after five years as project engineer with The Stanley Works.

New president and general manager of Pacific Coast Engineering Co. is **C. D. Ramsden** who has been vice-president and general manager since 1956.

Kirke W. Connor, who founded Micromatic Hone Corp. in 1929, was recently elected chairman of the board. Succeeding him in his former office of president is **Don S. Connor** who also is general manager of the company. Mr. Don Connor, who is a member of ASTE's Detroit chapter, has been executive vice-president and general manager since 1955. Elected to fill the post of executive vice-president is **William H. Harris Jr.** who was vice-president of engineering. At the same time, directors elected **William J. Pinkerton** administrative vice-president. He has been vice-president in charge of manufacturing since 1952.

Allis-Chalmers Mfg. Co. has appointed **William H. Mutschler,** chief engineer of the Pittsburgh Works, to succeed **W. M. Terry, Jr.** who was recently named director of engineering coordination for the company's Industries Group. Mr. Mutschler's former post of patents and standards engineer at the Pittsburgh Works has been filled by **George Gallousis** who was an engineer in the instrument transformer section.

The Chaso Tool Co. has named **Ray Grose** to the post of plant manager. He previously was quality control manager of Lock Thread Corp.

Major appointments in Chrysler Corp's Stamping Div. included the naming of **William G. Martin** as divisional industrial engineer and the appointment of **Charles C. Mezey** as plant manager of the Nine Mile press plant.

R. L. Puette, and **B. H. Carlisle** have been made general divisional managers by The Clark Controller Co. Mr. Puette also will continue as vice-president of operations of the company.

Directors of the A. O. Smith Corp. at their annual meeting named 11 of the company's executives as new vice presidents. Four will continue to functions as members of management staff: **M. E. Morgan,** procurement; **W. W. Higgins,** engineering; **S. E. Wolkenheim,** marketing; and **R. F. McGinn,** research and development. Two new operating vice-presidents are **J. H. Brinker** and **John S. Randall.** Five regional managers were elected commercial vice-presidents for their respective areas: **W. W. Stake,** eastern region; **George P. Hough,** midwestern region; **L. M. Keating,** southwestern region; **Allen O. Dragge,** Pacific Coast region; and **Walter H. Porth,** in charge of relations outside the U.S.

Trade Literature

for free booklets and catalogs—use convenient request card, page 167

Tungsten Carbide Surfacing

Four-page bulletin, "Kenplate Tungsten Carbide Surfacing", describes new product and its uses in protecting metal parts against abrasion and wear and its application methods. Kennametal Inc., Latrobe, Pa. **L-2-1**

Chain Drives

Comprehensive, 88-page Book 2425 contains detailed engineering data and illustrations of versatillity of silent chain drives in a wide range of applications; includes tables of service factors, ratings, chain length and center distance computations; also outlines procedure for selection of engineered drives. Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill. **L-2-2**

Worm Gearing

Extensive line of worm gearing is presented in detail in 16-page illustrated Bulletin 700-C; contains specification drawings for all worms and gears, tool charts and horsepower ratings for numerous special gearset combinations, backlash tolerances, lubrication data and service factors plus ordering information with typical examples. Cone-Drive Gears, Div. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. **L-2-3**

Drills and Reamers

Tab indexed for quick reference, 96-page comprehensive Catalog 58 describes and illustrates line of carbide, cobalt and high-speed steel drills, extensive variety of reamers and various types of end mills; each item accompanied by table of standard sizes and dimensions; technical data section gives decimal equivalents, drilling recommendations, feeds, grinding drills, hole sizes for tapping, metric equivalents, etc. Request only on company letterhead directly from Greenfield-Ampco Drill Div., Greenfield Tap and Die Corp., Greenfield, Mass.

Broaching Tools

Complete line of Red Ring gear production equipment and broaching tools described in extensively illustrated 24-page Catalog AP57-11. National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich. **L-2-4**

Milling Machines

Series of bulletins (Special Bulletins No. 1, 2 and 3) describe and picture index method milling machines Model HV-44 H.D., NV-22 and RT-301 respectively. Each points out special features, advantages and applications of the model. The Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn. **L-2-5**

Spring Materials

How to design and select materials for springs that must operate successfully at high temperatures is discussed in informative 8-page bulletin, "High Temperature Springs". Explains mechanical and metallurgical considerations, some problems involved and suggests available solutions. Associated Spring Corp., Bristol, Conn. **L-2-6**

High Temperature Alloy

Two 28-page booklets present information on Haynes wrought cobalt base high temperature alloy No. 25 and nickel-base high temperature alloy X available in both wrought and cast form. Both booklets contain selections on physical properties, tensile data, stress rupture and creep data and also describe methods for welding, forming and machining the alloys, and on their resistance welding characteristics. Literature Distribution Section, Haynes Stellite Co., Div. of Union Carbide Corp., 30-20 Thomson Ave., Long Island City 1, N. Y. **L-2-7**

Brushes

Eight-page, illustrated folder discusses Situft and Helituf brushes designed to provide efficient, economical way to rebur or clean difficult jobs. Adv. and Sales Promotion, Osborn Mfg. Co., Cleveland 14, Ohio. **L-2-8**

Plant Maintenance

Bulletin describes operation and application of a system for machinery maintenance and quality control and the resultant cost cutting features. International Research and Development Corp., 797 Thomas Lane, Columbus, Ohio. **L-2-9**

Hydraulics and Lubrication

Illustrated by photos, drawings and diagrams, 20-page manual gives instructions for general hydraulic and lubrication system maintenance plus discussion of lubricants and a lubrication chart; includes operating description, cutaway views, hydraulic power circuits, lubrication system circuits and specification tables for various types of equipment; also provides engineering section of pertinent data. Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich. **L-2-10**

Tool and Die Makers

Extensively illustrated, 64-page brochure, "Service is Our Business," contains quick-reference tabulation of products and services provided by 80 firms of Southern California Tool & Die Assn., statements of policy and descriptions of specialties and facilities of individual member firms. Southern California Tool & Die Assn., P.O. Box 45263, Airport Station, Los Angeles 45, Calif. **L-2-11**

Lift Trucks

Sixteen-page brochure on "Mechanical and Hydraulic Hand Lift Trucks" describes what they are, how they operate, how to select and how to use them; illustrated. Association of Lift Truck and Portable Elevator Manufacturers, Suite 759, One Gateway Center, Pittsburgh 22, Pa. **L-2-12**

Thread Chasing

Series of technical Bulletins (Nos. 115, 116, 117 and 118) provide information on solid adjustable taps, chaser chamfer grinding fixtures, self opening die heads, and thread chasing tools; all are illustrated. Chaso Tool Co., Inc., Box 268, North Branch, Mich. **L-2-13**

Honing

Illustrated 32-page service and equipment contains brief explanation of Microhonoing process, plus capacities and specifications of representative range of equipment for cylindrical, spherical and flat applications; also describes facilities for job Microhoning and field servicing of honing equipment, Micromatic Hone Corp., Detroit 38, Mich. **L-2-14**

Grinding

ASA approved standard B5.35 on "Machine Mounting Specifications for Abrasive Discs and Plate Mounted Wheels"; includes such information as location and size of bolt holes in steel disk wheels, definitions and standard sizes for abrasive disks in the inserted nut, inserted washer, tapped mounting plate, projecting stud and cylindrical types; also covers plate mounted wheels; illustrated. Grinding Wheel Institute, 2130 Keith Bldg., Cleveland 15, Ohio. **L-2-15**

Stitching

Detailed information on stitching metal to metal or metal to nonmetalic materials presented in 16-page booklet "Metal Stitching, A New Idea in Fastening;" photos and drawings illustrate equipment and applications typical. Acme Steel Co., 135th St. and Perry Ave., Chicago 27, Ill. **L-2-16**

Grinding

Two extensively illustrated brochures describe R4 series of automatic hydraulic grinding machines emphasizing important features and advantages; outlines standard and special equipment; drawings show details of grinding operations; include tables of dimensions and specifications. Olivetti Corp. of America, Machine Tool Div., 42-33 Northern Blvd., Long Island City, N.Y. **L-2-17**

Adjustable Speed Drive

Illustrated by photos, drawings and graphs, 12-page Bulletin No. 2000 presents details on Select-A-Spede adjustable speed drive; includes information on applications, installation and optional features for special applications. The Louis Allis Co., 427 E. Stewart St., Milwaukee 1, Wis. **L-2-18**

Taps

Informative 22-page Catalog No. 27 incorporates engineering data on taps and tapping as well as specifications and descriptions of line of standard and special taps; illustrated. Royco Tap and Tool Corp., North Branch, Mich. **L-2-19**

Arbors, Holders and Chucks

Extensively illustrated with engineering drawings to show construction and features of various items in line, 28-page Bulletin No. WA-10 presents information on interchangeable extension arbors, wheel holders and collet chucks; includes specifications and dimensions. Pope Machinery Co., Haverhill, Mass. **L-2-20**

Toolholders and Inserts

Illustrated 56-page manual discusses how to effect savings in machining costs through use of company's toolholders and inserts; covers selections of toolholders to fit specific metal cutting jobs and the factors bearing on choice of toolholders; also offers information on turning, including angle, plunge, offset, lead angle turning, turning and facing, facing, 15 deg lead angle facing; thoroughly covers how to use the toolholders as well as other pertinent tips of interest to users, and gives table of surface speeds for high-speed steel, Tantung and cemented carbides. Request only on company letterhead from Vascoloy-Ramet Corp., Waukegan, Ill.

Bending

Specific application information on bending of pipe, tubing or structural shapes presented in 34-page booklet, "Please Take a Peek," showing in-plant pictures of rotary, ram and rool bending types of bending. Wallace Supplies Mfg Co., 1300 Diversey Pky., Chicago 14, Ill. **L-2-21**

Turret Lathes

Ten-page catalog, Form 1182-A, presents detailed discussion of construction, operation and features of automatic ram type turret lathes with hydraulic drive; well illustrated. Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis. **L-2-22**

Grinders

Rotary surface, external and internal grinders and the Jigmatic positioning table are described and illustrated in 8-page folder; includes specifications and dimensions. Arter Grinding Machine Co., 15 Sagamore Rd., Worcester 5, Mass. **L-2-23**

Jig and Fixture Components

More than 400 components for jigs and fixtures and more than 200 clamping items covered in 16-page Catalog No. 28; includes scale size tracing template of the jig and fixture components. Northwestern Tool & Engineering Co., 117 Hollier Ave., Dayton 3, Ohio. **L-2-24**

Fastening

Comprehensive 42-page "Fastener Fact File" contains complete design and purchasing information on rivets and riveting machines; also includes an evaluation questionnaire to help user determine which type of fastener to use, and a rivet standards chart. Request only on company letterhead to Judson L. Thomson Mfg. Co., Waltham 54, Mass.

Arbors and Chucks

Complete dimensional data for selection of interchangeable extension arbors and tapered shank collet chucks for internal grinding spindles and milling spindles presented in 30-page Bulletin WA-10 which describes and lists 250 styles and sizes; also offers information on self removing wheel holders for all types of tool and cutter grinders, vertical, cylindrical and surface grinders. Pope Machinery Corp., Haverhill, Mass. **L-2-25**

Hydraulic Fluids

Bulletin No. 1300SA, "Selection, Operation and Maintenance of Hydraulic Fluids for Industrial Machinery," describes both desirable and undesirable characteristics of petroleum base and fire resistant hydraulic fluids; also tells how to select best fluid for specific job, how to care for it and how to correct trouble when it occurs, and outlines number of trouble shooting tips. Adv. Dept., Vickers Inc., Box 302, Detroit 32, Mich. **L-2-26**

technical Shorts

A NOVEL technique for placing a hard, refractory, smooth and wear-resistant carbide coating on machined graphite parts appears to permit increased usage of the parts involved, thus providing economy. The coating is integrally bonded to the graphite, and can be as smooth as the base graphite can be prepared. Coatings are complete, even in undercuts, holes, drilled areas, milled sections, etc. Thicknesses can be varied between 40 and 250 microns. Above this limit, the material tends to exfoliate or scale off.

Method Achieves Smooth Carbide On Graphite Base

In the specified thicknesss, the coating shows good heat shock resistance and integrity under cyclic conditions. Melting point is 2000 C, with a hardness of 2000 Vickers minimum. In reducing and vacuum atmospheres, the coating is chemically stable.

The material shows a fair degree of oxidation resistance. However, the researchers suggest additional work on the coating may increase oxidation resistance of the material substantially.

Dr. Morris A. Steinberg, head of the Metallurgy department of Horizons Inc., concludes that while basic research on the coating and process of application have been completed, specific application studies remain to be undertaken.

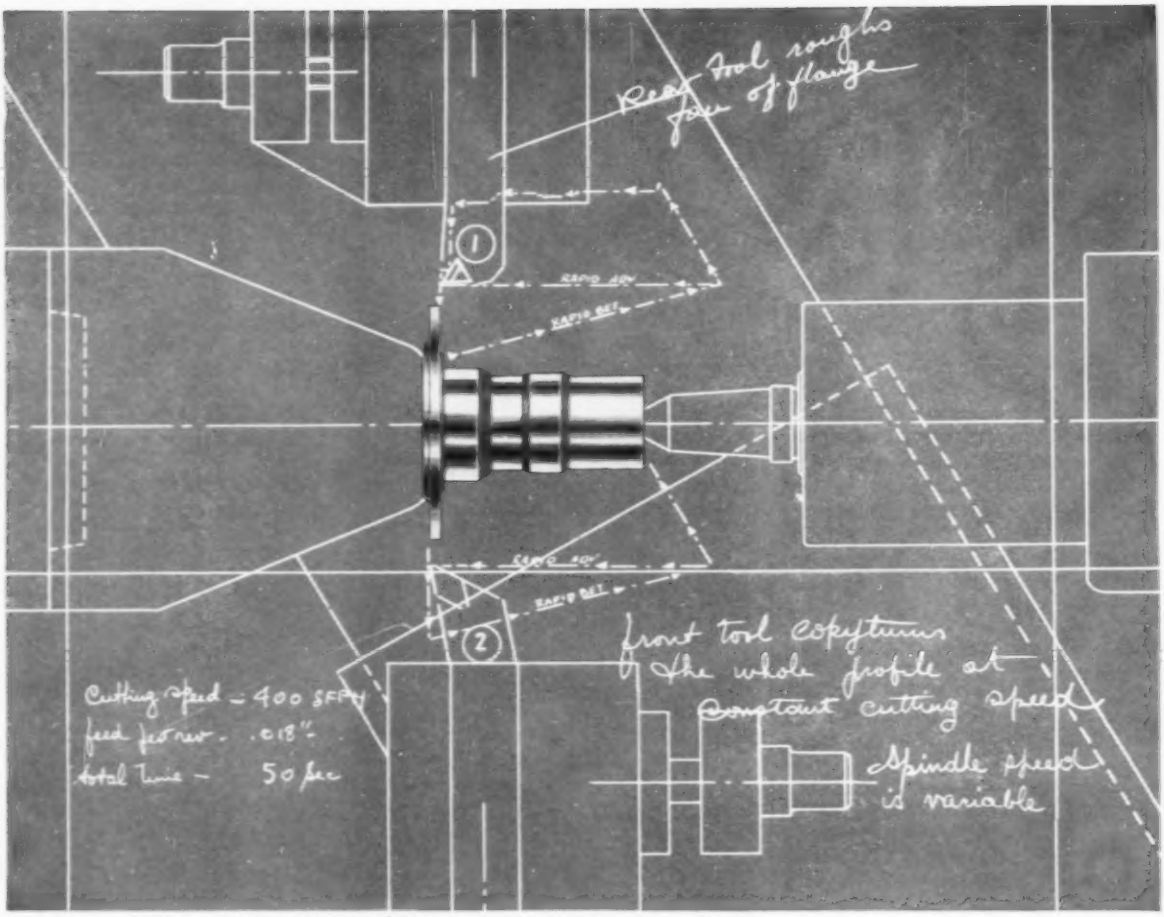
* * *

PLATING solutions to allow tin and lead to be plated singly or in combination in any proportion have been developed by Dalic Metachemical Ltd. High-lead-content alloys (93 percent) are suitable for bearing applications; 60-40 tin-lead alloys are useful for components requiring subsequent soldering. Mixing solutions in proper proportions by volume allows any intermediate percentages for special purposes to be readily achieved. Both the plating solutions are slightly alkaline and will not set up corrosion cells, cause embrittlement nor attack different neighboring metals.

Solution Plates Tin and Lead Simultaneously

The process itself is said to be easy to use. A special rectifier transforms 220 v alternating current into direct current, while a voltage from 0 to 35 can be selected. Most plating is carried on at about 8 to 20 v. A cathode lead, clamped to the part, and a stylus, which applies the electrolyte, send the current through the part to be plated. The stylus includes a graphite anode, wrapped in cotton and saturated in the plating solution. According to the researchers, any metal may be plated on almost any other simply by choosing the proper electrolyte.

Intended primarily for smaller areas, limit for the process is normally 2 sq ft. Larger units, however, may be plated in prototype work or if unusually large, special plating tanks are built to accommodate the part. Ordinarily almost any metal from bismuth to zinc may be deposited without plating tanks; only a change of plating stylus and electrolyte is required.

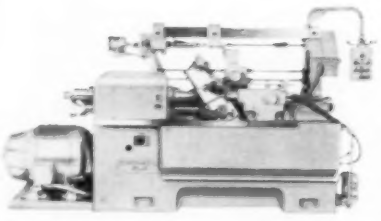


In 50 seconds

the Conomatic Pilot copyturns this entire profile at constant cutting speed

The Conomatic Pilot is the only multicycling copying lathe that provides constant feed per revolution by means of a piloted hydraulic feed—an important reason why you can profile turn parts like this to very close tolerances on all surfaces at full production speeds. When used for finishing only, the Conomatic Pilot can often eliminate green grinding operations.

Write today for details of the Conomatic Pilot lathe.



The Conomatic Pilot Model KU is a hydraulically-controlled multicycling copying lathe that can automatically reproduce practically any profile, using a motorized rotating template. It can be adapted to a wide variety of slides and tool stations.

Conomatic

CONE AUTOMATIC MACHINE CO., INC., WINDSOR, VT.

PILOT DIVISION

30 Rockefeller Plaza, New York 20, N. Y.

FIELD notes

education

A Chair of Metallurgical Engineering has been established at the Carnegie Institute of Technology by Firth Sterling Inc. The step, which enlarges the scope of the company's research activities, represents a gift of $24,350,000 to the development program currently under way at Carnegie. The Chair will be occupied by Dr. Harold W. Paxton, assistant professor of metallurgical engineering and also research metallurgical engineer in the Metals Research Laboratory at the Institute.

v v v

A four-year science and engineering scholarship open annually to sons and daughters of employees has been established by The Fafnir Bearing Co. The scholarship will be worth up to $1,000 and will be renewed yearly if a satisfactory academic standing is maintained. Candidates may attend any accredited college but must study in some field of science or engineering. Winners will be selected on the basis of character, scholastic record and financial need. Colleges also will receive a company gift of $250 annually for each student studying on the Fafnir scholarship.

new companies

Formation of Chempro, Inc. was announced by Dr. J. A. Patterson and Carl Labovitz, president and vice-president-treasurer, respectively, in the new firm. Its offices are in the Plaza Bldg., Pittsburgh. The company will be engaged in general engineering and consulting work specializing in chemical processes for industry.

v v v

Formation of General Vacuum Corp. has been announced by W. G. Overacker, its new president. The company, located at 400 Border St., East Boston, Mass., plans to concentrate efforts initially on engineering, development, testing and sales of intermediate sizes of special high vacuum equipment and on developing an improved line of pilot plant induction and arc melting vacuum furnaces. Arrangements have been made for Artisan Metal Products, Inc. to fabricate equipment to General's design.

v v v

Establishment of Production Threaded Parts Co. has been announced by Leslie Akers who will head the new firm. It is located at 4251 John St., North Branch, Mich.

acquisitions

An agreement whereby the Double A Products Co. of Manchester has joined Brown & Sharpe Mfg. Co. as a wholly-owned subsidiary was announced simultaneously by the presidents of the two companies. According to the announcement, operations of both Double A's valve manufacturing unit and Brown & Sharpe's pump facilities will continue as in the past. No plans for relocation are contemplated.

v v v

Crucible Steel Co. of America has acquired full ownership of Rem-Cru Titanium, Inc. from Remington Arms Co. The transaction involved an exchange of 150,000 shares of newly issued Crucible stock for 5,000 shares of stock and $2,800,000 in notes of Rem-Cru. According to company announcement, Rem-Cru will be integrated with Crucible to effect economies in operation.

v v v

Announcement of acquisition of Vico International, Inc. has been made by Aluminum & Chemical Corp. It will be operated as a wholly-owned subsidiary of Alchem with offices in Greenwich and plant facilities remaining in Garden City Park, L.I., N.Y.

v v v

Howard Industries, Inc. has purchased the Universal Motor Div. of Westinghouse Electric Corp. in Lima, Ohio. All assets of the division except land and building were involved in the transaction, and Howard agreed to continue servicing all Westinghouse customers who have bought universal type motors. All machinery and equipment is being moved from Lima to a recently completed Howard plant in Racine.

v v v

Majority of the Griffith Bros. Co. has been acquired by Circon Component Corp. The facilities will be devoted to manufacture of Circon precision instrument screws and related indicator and connector parts and to custom screw machine work. The new addition will be known as the Griffith-Circon Corp.

product transfers

Sale of the entire Cold Heading Dept. of its Waterbury Mfg. Co. Div. to Connecticut Screw & Rivet Co. and its affiliate, Anchor Fastener, Inc. has been announced by Chase Brass & Copper Co. Purchase included all facilities such as dies, tools, prints and other information necessary to production of cold headed products formerly made by the Chase division.

v v v

Hercules Motors Corp. will take over manufacture of two Lycoming air cooled industrial engines now being made by Lycoming Div. of Avco Mfg. Co. a a result of a cash transaction between the companies involved. According to the announcement, Hercules has acquired the tools, dies, patterns, inventory and know-how to start production of engines at its Canton plant about March 1.

new facilities

Firth Sterling Inc. officially marked the opening of its new tungsten carbide sintering facilities with an open house at its Los Angeles warehouse in January. The new facility is equipped to make semistandard and special shapes previously manufactured in the East.

v v v

A plant in the Chicago area has been opened by American Bosch Arma Corp. for the design, development and production of complex test equipment and ground support equipment. Address of the plant is 5851 W. 95th St., Oak Lawn.

v v v

A high precision gage testing laboratory for measuring accuracy of gages, jigs, dies, piece parts and fixtures has been made available to industry by Size Control Co. Facilities of the lab, designed and equipped to measure instruments to accuracies under conditions

specified by the Metrology and Gage Div. of the U.S. Bureau of Standards, are available to any company. Any item submitted for test is returned with a written certification telling how the test was performed and the results of the test.

v v v

Opening of a Southern Branch in the Freestate Industrial Park area of Shreveport, La., has been announced by Simonds Saw and Steel Co. Planned as a distribution, sales and service center, the branch brings full stocks of products made by Simonds Saw and Steel and its subsidiaries, Simonds Abrasive Co. and Heller Tool Co. to customers in the central south.

new offices

An Eastern Div. office has been opened by Wales-Strippit Co. at 537 E. Delavan Ave., Buffalo, N.Y. It is handling all sales and service to metalworking, electronics and fabricating plants on the Eastern seaboard. William A. Schrader who has been at the company's plant in Akron, N.Y., is divisional manager.

v v v

A West Coast office has been established by PIC Design Corp. at the Surety Bldg., 7335 Van Nuys Blvd., Calif.

v v v

Westinghouse Electric Corp. opened a new apparatus office in Compton, Calif. to offer sales, engineering and service facilities in the Los Angeles area. Carl W. Waldow manages the operation.

corporate changes

A controls section of Bendix Aviation Corp. has been established to engineer, manufacture and sell tape-controlled production systems, including equipment that will use blueprint measurements to produce a finished part. In the new operation, located at 21820 Wyoming, Detroit, Mich., Bendix will design and build completely automated systems, including associated electronic equipment and drives, to control machine tools in all cutting functions.

v v v

The Stupakoff Div. at Latrobe, Pa. and Globar Div. at Niagara Falls, N.Y., and the Refractories Div., Perth Amboy, N.J., have been integrated into one division which is identified as the Refractories Div. according to announcement from the parent organization, The Carborundum Co. All personnel, plants and activities except the Stupalox sintered oxide cutting tool project formerly at the

Stupakoff Div. are combined in the newly established division. The Stupalox project has been assigned to the New Products Branch of the Research and Development Div.

V V V

Sealol Corp. has organized a new Acra-Ment Instrument Div. as a result of the recent acquisition of the Myer Corp.'s indicating gage line. Facilities of Sealol's Anchor Tool and Die Div. will be utilized in manufacture of the gaging instruments.

name change

LeMaire Tool & Mfg. Co. has changed its name to LeMaire Machine Tool Co. in order to reflect more accurately the company's present activities.

expansions

Addition to its facilities on its 14 acre site adjacent to the Torrance Municipal Airport in Calif. is reported by Hi-Shear Rivet Tool Co. The new building will be used for heat treating titanium, for heat treating special high temperature superalloys, and for experimental processing of new materials in conjunction with the company's research and development programs in the fastener field.

V V V

Ground has been broken for a new $350,000 split ballbearing plant in Lebanon, N.H. for Miniature Precision Bearings, Inc. Plans call for a 30,000-sq ft plant to be completed by early next summer.

V V V

Construction is under way on a plant in Auburn, near Worcester, Mass., for Lodding, Inc. The new facility will have 52,000 sq ft of manufacturing space plus office space.

V V V

A warehouse which more than doubles previous facilities in the New England territory has been completed for Vanadium-Alloys Steel Co. near Springfield at Agawam, Mass. The building, designed and equipped specially for efficient handling of tool and die steels, will carry complete stock of high-speed, die and tool steels for special purposes in the form of bars, plate, sheet, circles and forgings.

V V V

To meet growing needs of West Coast industry, Handy & Harman is building a new and larger plant at 33 N. Gibson Rd., El Monte, Calif. The new facility will cover more than 23,000 sq ft and

house office, laboratory, refinery, operating area and warehouse. It will have twice the capacity of the plant which the company opened last April in Los Angeles. The plant, which is the company's fifth, is scheduled to begin operation in February.

v v v

During the past year. The Federal Machine and Welder Co. has completed a program of acquisition of about $750,000 worth of new equipment and additional facilities and has obtained controlling interest in Berkeley-Davis, Inc., manufacturers of automatic arc welding equipment and special machinery. The acquired firm will use present sales outlets of Federal Machine.

moves

General Machine Products Co., Inc. has moved into a new 60,000-sq ft plant located adjacent to the Philadelphia Interchange of the Pennsylvania Turnpike in Trevose, Pa.

v v v

Operations of Tipptronics, Inc. have been transferred from Tipp City, Ohio to Chagrin Falls, in the greater Cleveland area.

sales

With opening of a new caster plant in Jonesboro, Ark., The Colson Corp. has changed its sales organization to provide more effective service to its customers. Sales headquarters for caster and institutional products have been moved from Elyria, Ohio to Jonesboro. The Special Products Div. is now handling sales for electric hydraulic lifting equipment, conveyor systems and Structo steel angles. Sales headquarters now are located at the plant in Somerville, Mass. Sales of Handler and Motowlift parts remain in Elyria.

v v v

Five new mid and southwestern distributors have been set up by Sheffer Corp. for its line of air and hydraulic cylinders and accessories. They include The Baker Engineering and Equipment Co. of Wichita, Kan.; Baker Fluid Power, Inc. of Kansas City, Mo.; St. Louis Compressor Service Co. of St. Louis, Mo.; Industrial Air Controls, Inc. of Ft. Worth and Dallas, Texas; and Machine Tool and Supply Co. of Tulsa, Okla.

v v v

Lake Erie Machinery Corp. has named Archie J. Smith, a veteran of 18 years experience in the field, its west coast representative. He has established offices at Van Nuys, Calif.

who's meeting and where

Feb. 3-4. Instrument Society of America. Conference on progress and trends in chemical and petroleum instrumentation, Wilmington, Del. For more data write to H. S. Kindler, director of technical programs, ISA, 313 Sixth Ave., Pittsburgh 22, Pa.

Feb. 4-6. The Society of the Plastics Industry, Inc., Reinforced Plastics Div. 13th annual technical and management conference and industry exhibit, Edgewater Beach Hotel, Chicago, Ill. Contact society office, 250 Park Ave., New York 17, N. Y.

Feb. 13-15. National Society of Professional Engineers. Spring meeting, Michigan State University, East Lansing, Mich. For details contact society headquarters, 2029 K. St. N.W., Washington 6, D.C.

Feb. 18. Rochester Society for Quality Control. 14th annual quality control clinic, War Memorial, Rochester, N. Y. For details, write to Edward F. Winterkorn, Eastman Kodak Co., Navy Ordnance Div., 50 Main St. West, Rochester 14, N. Y.

Feb. 24-28. Machine Design Seminar, sponsored by the Lincoln Electric Co. Details may be had from Robert Wilson, Dir. of Application Engineering, The Lincoln Electric Co., Cleveland 17, Ohio.

Mar. 10-20. University of Illinois. 11th annual short course in Quality Control by Statistical Methods, offered by University's College of Engineering with cooperation of Div. of Engineering Extension at Urbana. For further information write to Prof. John A. Henry, Room 205, Mechanical Engineering Laboratory, University of Illinois, Urbana, Ill.

Mar. 12-14. Pressed Metal Institute. Spring technical meetings, Sheraton-Cadillac Hotel, Detroit, Mich. For details write to institute office, 3673 Lee Rd., Cleveland 20, Ohio.

Mar. 16-22. American Society of Mechanical Engineers. Nuclear congress, International Amphitheatre, Chicago, Ill. More information is available from society offices, 29 W. 39th St., New York 18, N. Y.

Mar. 17-18. Steel Founders' Society of America. 56th annual meeting, Drake Hotel, Chicago, Ill. Request more data from society headquarters, 606 Terminal Tower, Cleveland 13, Ohio.

Mar. 17-21. Engineers Joint Council. Nuclear Congress, sponsored by 30 national groups. International Amphitheatre and Palmer House, Chicago, Ill. For information address congress manager, American Institute of Chemical Engineers, 25 W. 45th St., New York, N. Y.

Apr. 13-18. American Chemical Society. Spring meeting, San Francisco, Calif. Send inquiries to society offices, 1155 Sixteenth St., N.W., Washington 6, D. C.

Apr. 14-18. American Welding Society, Inc. Annual national meeting and welding show with ASME conference, Statler and other hotels, St. Louis, Mo. Write to society headquarters, 33 W. 39th St., New York 18, N. Y. for more details.

Apr. 16-25. British Electronics Show, Olympia Hall, London, England. Inquiries or space applications may be addressed to the organizers: Industrial Exhibitions Ltd., 9 Argyll St., London, W.1, England.

Apr. 22-24. American Society of Lubrication Engineers. Annual meeting and exhibit, Hotel Cleveland, Cleveland, Ohio. Write for more data to society office, 84 E. Randolph St., Chicago 1, Ill.

Apr. 27-May 1. The American Ceramic Society. 60th annual meeting, Penn-Sheraton Hotel, Pittsburgh. Contact society headquarters, 4055 N. High St., Columbus 14, Ohio, for more details.

May 1-8. American Society of Tool Engineers. 6th annual meeting and 1958 Tool Show. Bellevue Stratford, Sheraton and Benjamin Franklin Hotels and the Philadelphia Convention Center. For details, contact Society headquarters, 10700 Puritan Ave., Detroit 38, Mich.

May 5-9. American Society of Training Directors. 14th annual conference, Sheraton-Park Hotel, Washington, D.C. For further information write to the conference, ASTD, P. O. Box 958, Washington 4, D.C.

good READING

MAGNESIUM CASTING TECHNOLOGY—*By A. W. Brace and F. A. Allen. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $4.95. 174 pages.*

Successful production of magnesium alloy castings depends upon the careful observance of certain well-established principles. Specialized foundry technique is required, but this is because of particular chemical and physical properties of the metal. These characteristics must be recognized for a complete understanding of magnesium practice.

The science and art of magnesium alloy founding has been treated in elementary, yet adequate, terms. Each technical aspect of the art is described in subsequent chapters, the first part of each being reserved for discussion of the theory on which the practice is based.

The book presents objectively both British and American practice against a background of the more basic chemical and physical properties of the metal.

METAL CUTTING TOOL NOMENCLATURE—*Published by Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y. Price $4.50. 107 pages.*

In an effort to clarify the nomenclature and definitions of metal-cutting tools, the Metal Cutting Institute has published a new booklet which defines and illustrates the common metal-cutting tools. It is an attempt to reduce the amount of ambiguity found between various industries when referring to the same metal-cutting tools. In the past, this condition has contributed to much confusion, loss of time in interpreting specifications and often costly errors.

The book is divided into nine parts, which include twist drills, combined drills and countersinks; reamers; counterbores and spotfacers; taps, dies and threadchasers; milling cutters; hobs; gear shaper cutters; gear shaving cut-

ters; and broaches. In each area, the definition of the tool is given, general classifications and illustrations of the common form of the tool as used in industry. Nomenclature and other terms relating to the specific process are given following the illustrations in each section.

INDUSTRIAL DESIGN—*2nd Edition—By Harold Van Doren. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $6.50. 371 pages.*

With shapes and design affecting so much of the thinking of engineers in the mass production industries, an understanding of the principles of design is necessary. This book supplies an understanding in simple, nontechnical language with many examples.

The history of man and design is traced from the early beginnings in the cave to today's industrial designers. The place of design in industry is outlined to illustrate how it affects the thinking of the engineers and people responsible for making the products.

The author outlines an attack to the problems of design by dividing it into four distinct areas, including research for data, objective analysis of the data, the practical requirements and the merchandising requirement of the product. Then, he discusses the design elements, e.g., space dimensions, subtleties and streamlining making use of many illustrations to show how these effects are used in design.

The author presents the use of identification and data plates in an interesting manner. Many illustrations on the shapes, lettering and use of three dimensional identification clarify the principles of good and bad design.

Other interesting sections include the use of color, presentation of the design and a frank discussion of ethics. In addition, the determination of fees, methods of payment, and the evaluation of the design results for charges are included.

IRON AND STEEL INDUSTRY—*by Tom Campbell. Published by Bellman Publishing Co., Cambridge 38, Mass. Price $1.00. 40 pages.*

This monograph outlines the history of the steel industry, employment qualifications, and the training required for positions in it. Written in an easy-to-read style, the opportunities for advancement, the current average earnings levels, sources of additional information, and the union question are objectively discussed.

TOOL ENGINEERING in Europe

By M. Kronenberg
Consulting Engineer

Chip Deformation

According to an article in *Werkstatt und Betrieb*, No. 11, 1957, the Leyensetter pendulum makes it possible to test the machining characteristics of a workpiece on samples of the work material. Numerous tests were run by H. Vogt. The article is entitled, "Untersuchung der Verfromungs Vorgange beim Spanabhub mit dem Leyensetter Pendel."

The method has been developed over a period of many years as a short-cut for predicting plastic deformation of different types of steels, cast irons, etc., at various cutting speeds. A tool is attached to a specially designed pendulum, taking a chip off the material placed at a predetermined position underneath the pendulum.

The author differentiates between a zone of plastic deformation and a zone of separation and uses the ratio of these two zones as the machining criterion, which is called the "shape-changing capacity" (Formanderungs-vermogen).

Although it is not claimed that this factor can yet be used as a work standard, the author indicates that it is a very useful means—in conjunction with the physical properties of a material—of obtaining a guide for determining the probable surface finish and, hence, for changing the microstructure if the predicted surface finish is not satisfactory.

The author has also run a series of tests comparing the shape-changing capacity factor with the chip compression factor, which is the inverse value of the "cutting ratio" sometimes used in the United States. In the tests, materials are cut on a lathe. He found that this second factor gave the same results as the first factor.

A relationship was also found between the shape-changing capacity factor and the contraction of a material in a tensile test. The series of tests were run at various cutting speeds and proved

that a material can have identical shape-changing capacity factors at two different cutting speeds.

The article describes the instrument and tools used in the tests, and discusses the evaluation of the tests. The shape-changing capacity was determined for six different carbon steels of German standard "Ck." and for various heat treatments of Ck 45. Tests on nodular cast iron and gray cast iron were also included.

High-Temperature Hardness

An article dealing with surface hardness at elevated temperatures was published in the French periodical *Metallurgie et Construction Mecanique*, Vol. 89 (5), 1957, p. 487. This article was translated from a Russian publication on the subject by G. F. Belyaeva and M. G. Losinski.

The authors measured the surface hardness of various alloy steels in vacuum and at elevated temperatures, using loads from 0.3 to 11 kg (= 0.66 to 23.2 lb). They stress particularly the importance of correctly loading the indenter so as to avoid piercing the thin surface layer produced by different heat treatments. A method of selecting the most suitable heat treatment on the basis of such hardness tests is also described.

Surface Rolling

Surface rolling has been practiced for many years on the journals of railroad axles and similar workpieces of relatively large diameters. Considerable difficulties have been encountered in the case of small cylindrical parts ranging from 0.060 to 0.200 inch diameter.

G. Pahlitzsch and H. J. Voneitzen report on tests on rolling of such parts in *Werkstattstechnik und Maschinenbau*, No. 11, 1957, in an article titled, "Ueber das Gluttwalzen Kreiscylindrischer Zapfen mit Durchmessern von 1½ bis 5 mm in Einstechverfahren."

One of the main differences in the methods employed for surface rolling of large and small diameters lies in the direction of feed motion given to the surface roller. When the workpiece is large and correspondingly long, a longitudinal feed is used for the surface roller, moving it parallel to the work axis.

When the workpiece is small, it is necessary to feed the surface roller perpendicular to the workpiece axis, that is to employ a "plunge cut" motion. This term is to be taken as a comparison only, because cutting is not involved in surface rolling.

Another difference is the circumferential speed of the workpiece. These speeds go up to about 550 fpm in the case of large diameters. If such speeds

were used on small diameters, say 0.120 inch, it would be necessary to rotate the workpiece at about 17,000 rpm.

Likewise, the unit load recommended for surface rolling of large workpieces, about 11,000 lb per inch of width of the surface roller, would cause a considerable deformation and even destruction of small-diameter workpieces.

The authors have built a test apparatus for determining load data and other information described in the paper. On the basis of their investigation, which also includes a theoretical scientific analysis of the stresses, they come to the conclusion that the unit load must be considerably reduced in the case of small diameters, depending on the diameter itself. When the load limit is exceeded, the surface begins to peel off. They recommend, as a maximum, a unit load of 3850 lb per inch for a workpiece of 0.200 inch diameter and lesser loads for smaller workpiece diameters. Tables and diagrams included in the article contain detailed information.

In their analysis, the authors found that the greatest strain occurs somewhat below the work surface, a finding that was predicted by Hertz and Fopple for elastic deformation. This finding apparently also holds true for plastic deformation.

The diameter of the workpiece is reduced by the surface rolling operation, a fact that must be taken into consideration in the manufacturing process. Detailed data are given in the article. The surface finish of the workpieces before surface rolling was about 0.00012 inch to 0.00016 inch and was improved to 0.000005 inch to 0.000010 inch and less by the surface rolling operation.

Different types of surface rollers are described in the article, among them rollers with a helical surface for obtaining a gradual engagement.

Grinding Research

Two articles on grinding research carried out by K. Sato at Tohoku University are reviewed in *Stahl und Eisen*, Vol. 77 (18), 1957, p. 1262. The first article deals with the effect of depth of cut, chip cross section and grinding speed on the cutting forces, and discusses equations developed for tangential and radial forces. These results are compared to those obtained in experiments with a single abrasive grain scratching a sample and are also compared with experiments on seven different wheels.

The second article refers to the temperature distribution of 0.35 percent carbon steel during grinding with aluminum oxide wheels. The distribution is theoretically calculated and experimentally measured, and found to depend on cutting speed, feed and depth of cut.

Producibility Aspects of Advanced Aircraft

Tech Digests

By Alfred H. Petersen
Group Engineer
Producibility Methods
Lockheed Aircraft Corp.
Burbank, Calif.

As AIRCRAFT SPEEDS rise, skin temperatures also rise. Steels, refractory metals such as zirconium, vanadium and molybdenum, and composite materials with high melting temperatures will ultimately replace aluminium in aircraft structures.

Many of these alloys corrode and oxidize rapidly. Others have a definite limit of ductility which precludes using them in very many primary structural applications. Some, such as the cobalt-base, nickel-base and molybdenum-base alloys, are not heat-treatable except for possible aging treatments. Many, like the titanium alloys, exhibit tendencies to gall and drag during machining and some, like the chromium base alloys, can only be machined by grinding. One thing they all exhibit, in the hardened condition, is extreme reluctance to machining by conventional tools and techniques.

Many of these materials are now being used in jet engines, ram jets, rockets, and adjacent structures and components today. Thus, there are no mysteries attached to them until application to the type of airframe components that many of you are producing is considered, namely, large and complex extrusions, forgings, plates and billets.

Assuming that the present design concept of large skins and fittings continues, machining presents a critical problem. Stated simply, must the machining speeds as high as 15,000 sfm presently being used on aluminium be reduced to speeds as low as 65 sfm for the future production of similar high strength steel or titanium components? If true, a simple conversion in material without changing the design concept, presents what apparently is an impossible situation if airframes are to be produced in quantity for supersonic performance.

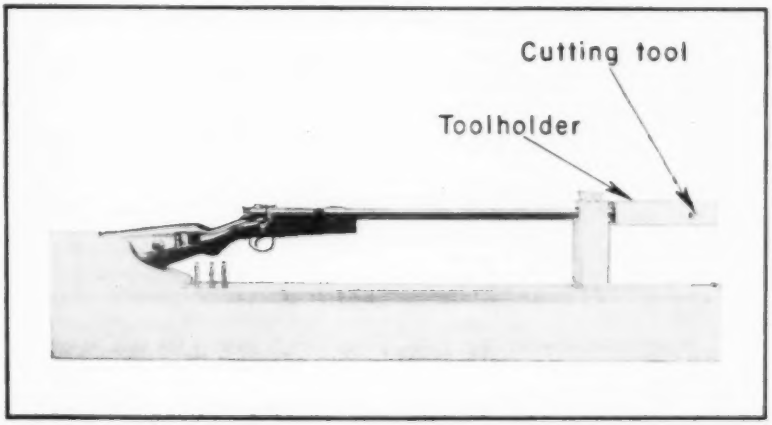
Those airframe companies which have integrated steel and titanium forgings and extrusions into their designs, are already aware of the situation. It has been stated that as high as 77 percent of a particular titanium forging must be reduced to chips. This accounts for the attempts being made, throughout the airframe industry, to initiate the necessary development to get various semifinished products produced more nearly to the actual sizes required.

If we assume for these high strength alloys, that in the immediate future no-draft forgings with thin webs and precise tolerances and thin wide profile extrusions will not be available, then one of three things must be done; provide much larger machining facilities throughout the country; design to reduce the amount of machining; or find new ways to machine.

Basic research on machining, particularly high-speed machining, may provide an answer. Work by Dr. Salomon as far back as 1931 indicates that beyond what has been called the "valley of death" where cutting tools fail rapidly under high rates of speed, there is a cutting velocity where failure does not occur.

For some time now, Menasco Mfg. Co. has been machining hardened steel landing gear components at speeds as high as 5,000 sfm. Recently, Dr. Max Kronenberg has reported good success working with a specially designed lathe at the LeBlond Co., machining carbon steels at speeds on the order of 10,000 sfm. Other isolated cases are also reported from time to time.

What is more important, however, is the fact that the Russians have apparently far outstripped us in reducing theory to practice. Phenomenal speeds and feeds have been reported through qualified sources. Eye witnesses say that the chips they have been producing are pyrophoric and disappear in thin air, with the workpiece assuming the color of a rainbow and the tool remain-



Test setup used to determine critical cutting velocities. Bullets graze cutting tool at speeds of 132,000 sfm.

ing cool at all times.

In discussing Dr. Salomon's and Dr. Von Karman's theories with Lockheed scientists and research personnel, good agreement was found that these theories are sound, although some modifications may be necessary. As a result, Lockheed initiated a series of tests intended to get some rough idea as to what happens to the workpiece and tools at very high velocities. The first problem was one of attempting to achieve the desired velocities and, having a number of gun enthusiasts at Lockheed who are constantly striving to obtain flatter trajectories with their rifle loads, it was decided to use the same techniques to supply some answers quickly and at moderate cost.

The rifle shown in the accompanying figure is a 30-06 caliber Mauser, having a smooth barrel bored out to accept a 0.30 inch diameter slug. On the end of this barrel is mounted a tool holder. Cartridge cases were loaded with various grades and quantities of rifle powders and slugs designed to fit the cases measuring two inches in length. These

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

slugs were AISI 4340 steel, heat treated to 280,000 psi, ultimate tensile strength.

First firings were made across single-point tools ground to a 90 deg included angle, and in various alloys and carbides. Initial firings were chronographed and muzzle velocities averaging 2,200 feet per second recorded. This was calculated to 132,000 sfm. A second series of tests were run with a flat-nose tool, and with these the speed was increased to 162,000 sfm.

In both series of tests, a definite cutting action was observed with only one tool failure. The cuts were smooth, the second group of slugs measuring 20 microinches. An increase in hardness of 1 to 4 points R_c was measured in the slugs to a maximum of .010 inch below the machined surface but otherwise no effect on structure or strength were measurable. To date we have not been able to observe the resultant chip. Further, more elaborate tests are planned which will be fully instrumented so that all variables can be studied. From these tests we expect to establish critical velocities for cutting all common aircraft materials being used.

Now someone is going to say that this work is all very well but how can these theories be reduced to practice? Frankly, this is not known today. The initial effort must be to establish the validity of the theories and then the machine tool builders must design tools with the necessary velocity and rigidity to reach the target. When it is realized that the power requirements fall off in inverse proportion to speed of cutting then the idea becomes more reasonable. It is believed that present work in dampening devices and the causes of acoustical vibrations may contribute something worthwhile. Thus, for linear and peripheral machining where access and cutter size are not limited it's a job of development.

To conclude then, the transition to stronger and tougher alloys than are being used today is going to be a slow process where airframes are concerned and for the next five years, at least, will not be completed. But in the field of machining, where great strides have already been made in shaping and automatic controls during the past few years, a still greater effort must be expended in research and development and into faster and more efficient machines, tools and techniques.

From a paper presented at the Third Annual Contour Machining Conference. True-Trace Corp., El Monte, Calif.

▼ ▼ ▼

New Techniques of Electromachining

By C. Paul Porterfield

Vice President
The Method X Div.
Firth Sterling, Inc.
Pittsburgh, Pa.

Electromachining can be divided into four basic groups: sparkover-initiated discharge machining, contact-initiated discharge machining, electrolytically assisted grinding and ultrasonic machining. Of these four groups, the latter is the only one that does not apply electrical energy directly to the workpiece to effect material removal.

In sparkover-initiated discharge machining, a potential is impressed between the tool and workpiece. The tool and workpiece are separated by a dielectric material, either a semisolid or liquid form. When the potential applied is sufficient to cause a rupture of the dielectric which separates the tool and the workpiece, a heavy discharge current flows through the ionized path. The current emanates from a point source on the workpiece and produces

in the workpiece, under the point source, high current densities which generate electrical force fields. The electrical force fields effect material removal. The workpiece is always the anode and the tool or electrode is always the cathode.

In contact-initiated discharge machining, the discharge is initiated by allowing the tool to contact the workpiece. After initial contact the tool is withdrawn and an arc is allowed to form. The tool is normally positioned in synchronization with the line frequency of the low voltage alternating current source which is connected to the tool and work. During the interval of time that an arc is allowed to exist between the tool and work, the temperature rises at the terminus of the arc. If a coolant, usually in the form of water, is applied, the resultant thermal shock will cause localized fracture of the material being machined and work will be performed. It is possible to operate this type equipment from a direct current source and in this instance, the duration of the discharge is controlled by the reciprocating motion of the electrode. When a direct current source is used, the workpiece is normally of positive potential. Material removal is effected by thermal shock.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

In electrolytically assisted grinding, work is accomplished by a flow of current through an electrolyte which separates the work and tool electrodes. In practical examples of this equipment this separation is effected by a single layer of diamonds on the grinding wheel electrode. The diamonds, in addition, brush away the metal oxides or metal salts which are formed on the work as a result of the current flow from the work through the electrolyte to the wheel. Were these oxides not removed, the machining action would steadily decrease in effectiveness as the salts built up an insulating layer. Because it is virtually impossible to remove the salts without touching the parent material, some diamond wear must of necessity occur. The rate of diamond wear is materially reduced from that figure com-

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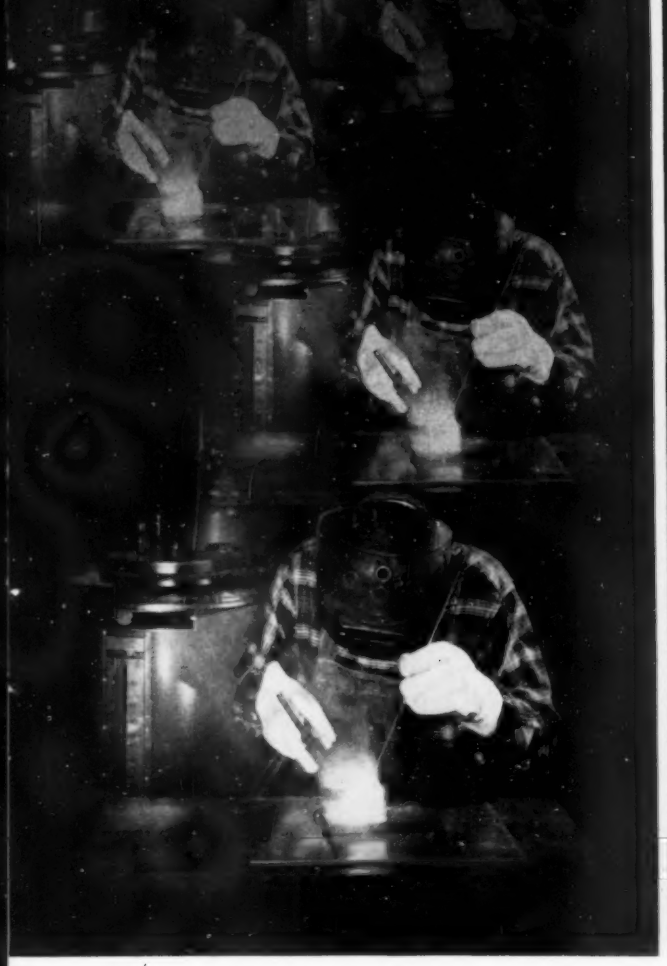

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mon to conventional diamond grinding.

The workpiece is normally of positive potential and the grinding wheel is negative. The liquid which separates wheel and work must be capable of carrying electrical current. This, in effect, is a reverse plating action aided by the diamond grinding which keeps the oxides from stopping the deplating action.

In ultrasonic machining the work is submerged under a slurry of finely divided abrasive in a vehicle which is normally water. The tool is coupled to a magnetostriction oscillator and is caused to vibrate at very low amplitudes at a rate of between 15,000 to 30,000 cycles per second. The travel of the moving tool drives the slurry into the workpiece and the abrasive material in the slurry causes removal of material. This is then an abrasive process.

From a paper presented at the National Production Meeting and Forum, Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

Molybdenum-Base Alloys

By A. J. Herzig

President
Climax Molybdenum Co.
Detroit, Mich.

There is increasing interest in molybdenum alloys for high-temperature service. In the present state of development, alloys of molybdenum with titanium have been the most fully investigated, particularly the alloy containing 0.50 percent titanium. The rupture strengths for 100-hr life of 30,000 to 35,000 psi at 2000 F and 50,000 to 55,000 psi at 1800 F for this alloy are substantially higher than the rupture strengths reported for any of the present super high-temperature materials. Scattered data on alloys containing larger additions of columbium and titanium and some ternary alloys indicate a rupture strength for 100-hr life at 2000 F of around 100,000 psi. Using this as a point of potential for molybdenum-base alloys, however, one must acknowledge that the strength potential has outrun the ability to work such metals.

The major technical problem of producing castings in large section size and in substantial quantity has already been solved. Molybdenum and molybdenum-base castings weighing up to 1000 lb have been produced.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

The major problems that stand between the extensive application of the new materials and the present state of their development are (1) increasing their resistance to oxidation at high temperatures, (2) development of a suitable coating to protect the metal at high-temperature service, and (3) the need for proper facilities to hot-work the metals on a laboratory test basis, leading toward the development eventually of commercial facilities.

In regard to the first and second problems, there are examples of metals which achieve oxidation resistance through the formation of thin oxide films and the possibility exists that a strong refractory alloy similarly endowed might be discovered. However, an early working solution is more likely to be obtained through coating the metal. Such coatings must have resistance to mechanical impact, resistance to hot-gas erosion, and resistance to thermal shock, in addition to the

capacity for excluding oxygen.

Molybdenum-base alloys will not solve all the high-temperature problems, but they have already demonstrated that they provide the solutions to some problems. The technology within the molybdenum-base alloys have been developed promises that the temperature range of application of metals will be greatly extended.

From a paper presented at the Annual Meeting, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

▼ ▼ ▼

The Growth of Sonics in Industry

By Robert L. Rod
President
Acoustica Associates, Inc.
Glenwood Landing, N. Y.

Fifteen years ago the sonics industry as we know it today was virtually nonexistent. With the exception of Sonar apparatus and fathometers, practically no equipment utilizing sonic energy for either gaining information or for performing useful work was available to the industrial market. The studies being conducted in the field were for the most part carried out by educational institutions with limited budgets, and, for the most part, any practical results were completely ignored by industry.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Today, the situation is quite different. We have an industry devoted to the practical application of sonic and ultrasonic energy, which is a recognized part of our economy. The members of the Ultrasonic Manufacturing Association alone manufacture equipment estimated at between $15,000,000 and $25,000,000 sales annually.

Most of you are familiar with some of the sonics products now available to industry; the status of several of these applications will be discussed in greater detail by other speakers on today's agenda. In general, it is interesting to consider the types of sonics equipment in terms of those which are used to perform useful work and further to show which are presently available and those which undoubtedly will be obtainable in the near future.

Equipment for drilling, grinding, cleaning, oil well drilling, degassing, emulsification, barnacle inhibition, soldering and welding, heat transfer improvement and boiler scale inhibition is available now. Equipment for plating, flotation, impregnation, particle precipitation, pickling, quenching, and etching is currently under development.

From a paper presented at the 1957 meeting, Acoustical Society of America, 205 West Monroe St., Chicago 6, Ill.

Organizing Engineering Work

By Charles H. Bayer
Consultant-Drafting Administration
General Electric Co.
Schenectady, N. Y.

Because much engineering and drafting work in each industrial organization is unique to its particular products or services, no single organization structure will meet the needs of all companies or perhaps even all components of a single company. However, there

are certain factors which should be given thoughtful consideration in the establishment of an effective engineering organization regardless of the specific products and technologies involved. Too often we may be misled by attempting to pattern an organization after a "typical" structural chart. It is quite possible that such a thing does not really exist. In light of this assumption I should like to direct your attention to an organizing process which can best be presented in terms of the following key steps.

- Establish the objectives of the organization and reduce them to writing.
- Determine the total work to be done in order to meet these objectives and define the work in terms of broad classes of actions to be taken, and objects on which these actions are taken.
- Divide the broad classes of actions and objects into work elements.
- Combine work elements into positions and positions into manageable groups and document by means of position guides, functional charts and organization structural charts.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

No presentation on organization would be complete without a reminder of the paramount importance of continuous strong leadership. The true leader not only has the ability to stimulate in others a real desire to perform at the highest possible level of effort, but knows how to plan and present assignments in such a way that each man understands why his individual position is important and why he must concentrate his efforts on that particular assignment. A good leader spots weaknesses where they exist and concentrates on developing logical and harmonious relationships.

Leadership, accepted and discharged will ensure attainment of the objectives of the organization—particularly when that organization has been the result of the application of sound principles for organizing and position design.

From a talk presented at the Engineering Institute on Drafting Organization, University of Wisconsin, Madison, Wis.

Patents and Small Business

By C. W. Ooms
LaSalle Steel Co.
Hammond, Indiana

It was a man with an idea, a man with an invention, a man with a small business, who was able to give our country all of the advantages that measure the American free enterprise system. It is, after all, usually the small business that technical urgency—an urgency brought idea.

A patent is nothing more than a grant by the United States to an inventor of the exclusive right to exclude others from using his invention for a period of 17 years. In exchange for this the inventor publishes a working description of his invention in the patent, so that when the 17 years have expired anyone can read the patent and, using its teaching, practice the invention. Neither the user nor the government pays for this use.

What has all this to do with small business? The expiring patents, of which there are as of today some 2,300,000, are the greatest library of practical applications of invention known to man. That repository of technical teaching is a vast resource of small business which cannot be valued, and it is accessible only because the patent system has made it so.

The patent system plays a far more vital part in the life of the small business that is actively using the opportunities for procuring patents afforded by the patent system. Many a small business is founded upon one or more patents. The patent system has in innumerable cases been the cause of the invention that led to the patent upon which the business was founded. Without the patent, many a small business would have been hopelessly and fatally outrun by its larger and more prosperous competitors.

The patent system assures small business an equality of opportunity in the competition for the free market, and with its greater flexibility, small business can better take advantage of the incentives which the patent system affords.

The opportunities of small business are still measured only by the boundless potentialities of this great country.

From a talk delivered at the opening of the mechanical exhibit at the Department of Commerce Bldg., Washington, D. C. LaSalle Steel Co., Hammond, Ind.

You learn a lot in a hundred years... especially in the hundred just passed

—the greatest century of technical progress the world has ever seen. Born as it was, on the brink of the era, the growing Bliss Company was in a position to make a number of contributions to pressed metal-working... the first inclinable press, for example, and the famous rolling key clutch, the toggle press principle, pneumatic clutches, these are some of the more important ones.

Proud? Of course we are—of these contributions and of the men who made them possible. For we've learned in our past century that: Any company, no matter what its size, is basically people... that a customer isn't a purchase order, but someone to whom we are responsible both now and in the future. This is part of what we mean when we say, "Bliss is more than a name... it's a guarantee."

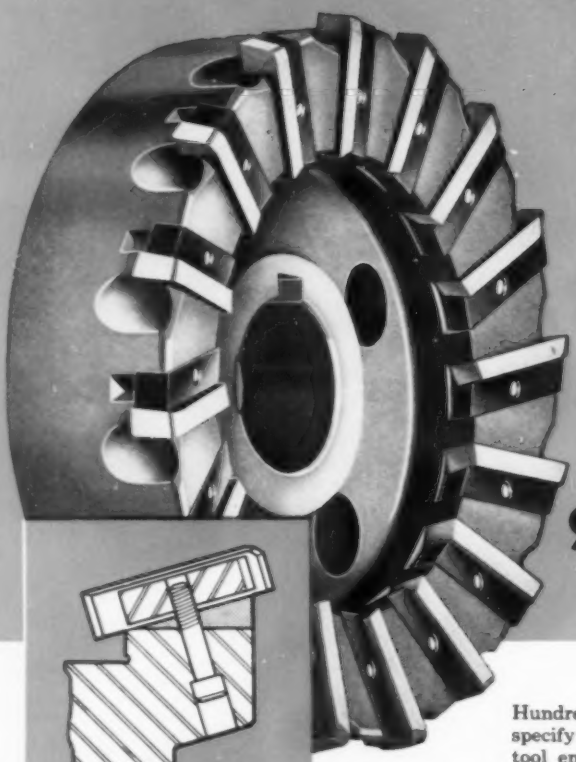
BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

100 years of making metal work for mankind

PRESSES • ROLLING MILLS • ROLLS • DIE SETS • CAN MACHINERY • CONTRACT MFG.

"10 YEARS ON THE JOB and our Super SOLID CARBIDE cutter's still going strong"



SUPER IBH CUTTER

For aluminum, steel, most other metals. All the features of our HBH Cutter except

- Blades are at 10° positive angle to radius
- Number of blades is diameter ÷2.

For efficiency, select the correct grade of carbide for the metal; grind to the proper angle. Your Super IBH Standard Cutter will do the rest!

Hundreds of tool men everywhere tell us willingly *why* they specify Super HPH and IBH Standard Milling Cutters. As a tool engineer, machinist or tool buyer you'll value these *reasons* why many shops have worked Super cutters for over ten years, always with economy and quality.

Here's why: For high speed machining of cast iron, malleable iron or brass, our HPH cutter has big *solid* carbide blades for maximum strength and elimination of braze strains. Blades are set radially, the number being the diameter x 2. You sharpen with a minimum removal of carbide—not the $\frac{1}{16}$" you lose with serrated-back blades—as Super blades can be moved a few thousandths or less at a sharpening. Then after scores of sharpenings, you use the carbide down to a stub because our wedge (with a filler-blade) gives you a locking area the complete length of the slot. The blade is solid as though part of the body itself since there are no back-up screws. If a wreck occurs—as it may in the best of shops—only the wedge is damaged or scrapped, not your cutter body. There are no threads in the body to strip as our wedges are tapped to take locking screws let in from the back.

The Super cutter body is #4130 Steel, heat treated for optimum strength. Drift pockets are machined under wedges for quick removal or adjustment. Mounting is versatile; it may be bolted on a #50 NMTB mount and it also has a keyway and ground bosses for arbor mounting.

Why not write for our complete catalog of solid and carbide tipped tools and the name of our stocking distributor near you. Thousands of satisfied tool buyers *must* be right; we'd like to have you join them.

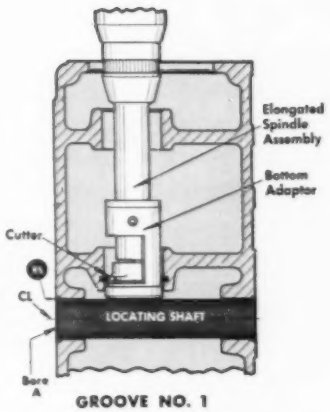
Super TOOL COMPANY

21650 HOOVER RD. • DETROIT 13, MICHIGAN

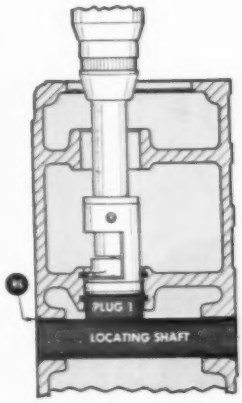
WAREHOUSES CHICAGO • DETROIT • NEW YORK • LOS ANGELES

Waldes Truarc Grooving Tool pays for itself with big savings on one small run!

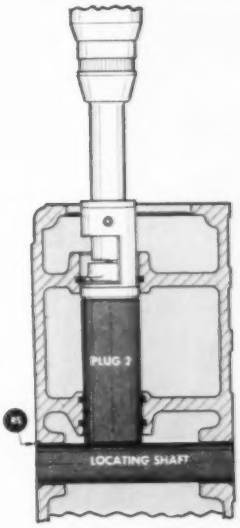
3 internal recesses cut in bores of 100 castings in 17.5 hours... including set-up time



GROOVE NO. 1



GROOVE NO. 2



GROOVE NO. 3

The job shown above called for three grooves located at prescribed distances from center-line CL of bore A. Depth and location tolerances: ±.0015".

Size and shape of the castings made nesting difficult for a boring bar operation. Exterior surfaces were unmachined, making alignment complicated. With two grooves over 7" from the housing's open end, boring bar chatter could have caused costly rejects.

To overcome these obstacles a Waldes Truarc Grooving Tool was equipped with an elongated spindle assembly and bottom adaptor. The tool was mounted in a drill press, the castings in a large vise. Grooves were then cut as follows:

Groove No. 1: A locating shaft was inserted into bore A as a reference surface and the tool piloted into the housing until the bottom adaptor banked on the shaft. The tool is designed so that the cutter rotates in a neutral position until additional downward pressure is applied. It then moves into cutting position until preset groove depth is reached, after which the tool idles. Release of pressure returns the cutter to neutral so that the tool may be withdrawn.

Groove No. 2: Plug 1 was inserted into the bore over the locating shaft and the tool again piloted into the bore. The groove was then cut the same way as Groove No. 1.

Groove No. 3: Plug 2 was substituted for the first plug and the cutting operation repeated.

All 300 grooves were held to prescribed tolerances. Set-up time: exactly 11 minutes. Operating time: 1050 minutes for 100 castings. Rejects: none!

No recessing problem is too tough for the amazingly versatile Waldes Truarc Grooving Tool. It's so simple even unskilled labor can use it accurately.

Write for a 20-page manual containing full information on Waldes Truarc Grooving Tool.

WALDES

TRUARC®

GROOVING TOOL

U.S. Pat. 2,411,426.

WALDES KOHINOOR, INC., 47-16 Austel Place, L.I.C. 1, N.Y.

Waldes Kohinoor, Inc.
47-16 Austel Pl., L. I. C. 1, N. Y.

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool. TE-020

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Title_____

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New CINCINNATI
flamatic®

In production, the machine shown uses multiple fixtures for selective surface hardening *1000 automotive rocker arms per hour.*

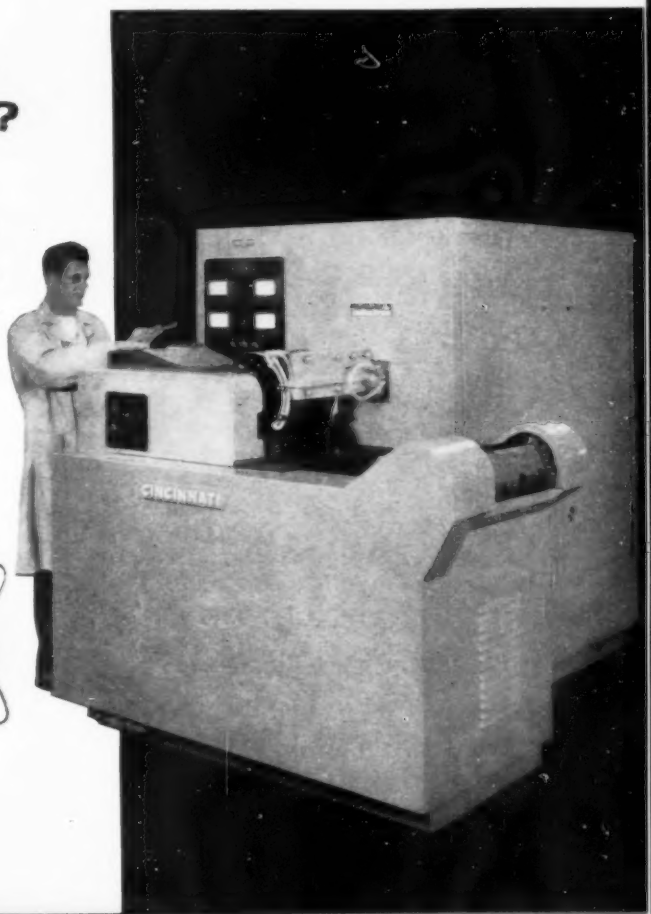
which

CINCINNATI

meets your selective surface hardening needs?

Your product components that require heat processing—such as selective surface hardening, annealing, brazing, tempering—can be Cincinnati-processed at a savings! New and versatile Cincinnati flame or induction heating machines can do the work you specify—and meet your cost-per-piece requirements-on high production quantities or varied, small-lot runs. Let a Process Machinery Division field engineer evaluate your needs. With the assistance of our extensive research laboratories and engineering facilities, he is ideally equipped to recommend the heat source and method that will be best and cheapest for you.

For machine descriptions and specifications, write for Flamatic Bulletin M-2015; Inductron Bulletin M-1993.

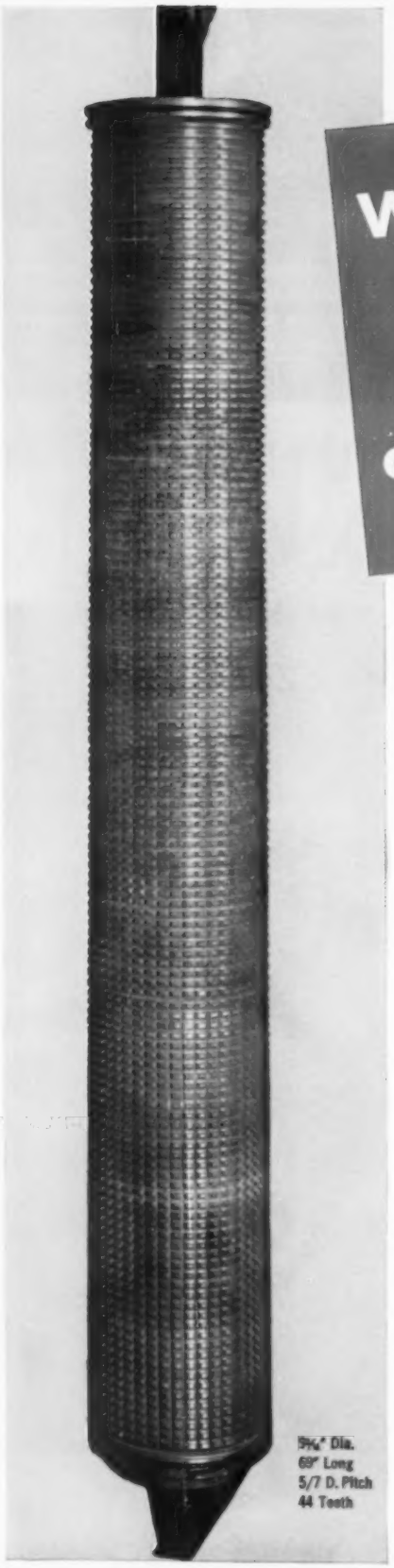


New CINCINNATI
inductron®

This machine induction hardens both ends of *automotive push rods at the rate of 3600 parts per hour.*

CINCINNATI
flamatic and inductron
hardening machines

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.



Who Would You Trust to HEAT-TREAT a BROACH Like This?

At the time this Red Ring Naloy Broach* reached heat-treat, about $5,000.00 had been spent on it. One mistake during the heat-treat operation could reduce it to scrap. In addition, the resulting delay might seriously disrupt our customer's production schedules.

These are only two of the reasons why Red Ring Broaches are heat-treated in our own plant under control of our own metallurgists. Here we have equipment especially designed and selected for just this type of work. Here we have an organization with a background of know-how that has been building up for the last 30 years.

Complete control over every production operation by men who KNOW broaches, gives the Red Ring Broach that extra precision—that extra service life—that added economy for the user.

***See the cover illustration of American Machinist, November 4 issue.**

7983

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Graph-Mo® dies cut downtime 50% on deep draw for round vacuum cleaner!

ENGINEERS at The Hoover Company had a tough problem in getting that round vacuum cleaner shape in the new Constellation. The two circular dies that form the hemispheres often galled, picking up bits of the steel being formed. This scored the dies, marred the finished parts. Production had to be shut down while the dies were repolished. And extra polishing of the hemispheres ran up costs still more.

After studying the problem, Timken Company metallurgists recommended dies made from Graph-Mo®—a special tool steel developed by the Timken Company. Results were outstanding. The new Graph-Mo dies cut downtime 50%. The combination of free graphite particles and diamond hard carbides in its structure make it outwear other tool steels 3 to 1. Production rolled smoothly and refinishing time was cut.

Graph-Mo machines 30% easier than conventional tool steels. And its uniform response to heat treatment eliminates distortion—saves time and money in lots of tough jobs.

Graph-Mo is one of four graphitic tool steels developed by the Timken Company. If you would like more information about their uses in dies, punches, gages and machine parts, send for the new Timken Graphitic Steel Book. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

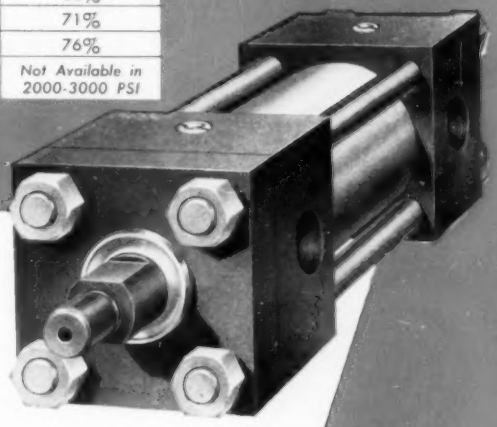
TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

Save 27% or more in cost...

NEW Miller "JOB RATED" HYDRAULIC CYLINDER LINE

JOB RATED, MODEL "LH"			
BORE	CONTINUOUS SERVICE RATING	INTERMITTENT SERVICE RATING	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1½"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	*Not Available in 2000-3000 PSI*



with IDENTICAL seals, design, and safety factors as the famous Miller "Power-Packed" Model "H" Line for 3000-5000 psi service.

ALL TEFLON* SEALED AGAINST EXTERNAL OIL LEAKAGE

SHEF SEAL
At Tubing Ends

Has zero axial clearance, metal backup, no "blind assembly." Teflon sealing strip of one cross-section dimension for all cylinder sizes—supplied on convenient spools.

Shear-proof
Heat-proof
Extrusion-proof
Fluid-proof

Piston Rod Flange Seal

Self-regulating, wear-compensating piston rod flange seal is pressure-energized, guaranteed leak-proof and never requires adjustment.

Teflon rod wiper keeps dirt out. Teflon hydraulic wiper keeps lubricant in.

Teflon sealing strip for bushing is one cross-section dimension for all cylinder sizes — supplied on convenient spools.

LOCK-SEAL
Cushion Adjusting Screw

Non-protruding screw automatically sealed and locked by Teflon ring. Interchangeable with ball check assembly for easy access.

CASE-HARDENED CHROME-PLATED PISTON RODS

Heat treated, stress relieved, high tensile steel piston rods, case-hardened, then hard chrome-plated.

NOW! . . . You can save MORE with quality Miller "Job-Rated" Cylinders than with cut-price, lesser quality hydraulic cylinders. And the "Job-Rated" Cylinders are also available under the same immediate shipment program (2 hours if necessary—3 days normal) as the Power-Packed Line.

*du Pont trademark for its tetrafluoroethylene resin

S SHEAR PROOF
H HEAT PROOF
E EXTRUSION PROOF
F FLUID PROOF
SEAL
Teflon Pressure Energized
Hydraulic Cylinder Tubing End Seal
PAT. APPLIED FOR

OTHER MILLER QUALITY FEATURES

- Rust-Resistant Surfaces
- Interchangeable, Space-Saving Square, 4-Tie-Rod Design
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MILLER FLUID POWER
DIVISION OF FLICK-REEDY CORPORATION

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AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

1st Choice

For Versatility and Adaptability

BULLARD Hydra-Feed Lathes

Rough forging of front axle spindle SAE #1037 Steel, Brinell Hardness 31-32 on the C scale.

The Senior Engineer at one of the leading motor car manufacturers in Detroit, was looking for a tracer lathe that went beyond his immediate requirement and offered easy conversion to other uses in years to come, to give longest tool life, to do the job with a minimum of shutdown time, to handle future developments in the realm of cutting tools, to reduce scrap to a minimum.

The answer to this multiple problem, according to the Senior Engineer was "BULLARD HYDRA-FEED TRACER LATHES."

We invite you to investigate the advantages which Bullard Hydra-Feed Lathes, either tracer or multiple tool models, offer you. Phone or write your nearest Bullard Sales Office, Distributor or

THE BULLARD COMPANY

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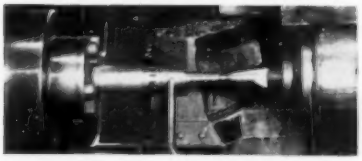


Rough turning with Rear Tracer Slide.

Finish turning with Right-Hand Top Tracer Slide

Finished piece complete cycle time — 65 seconds.

UNIVERSAL DRILL BUSHINGS

industry's standard of quality and service

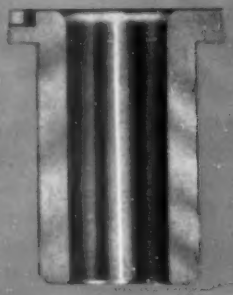
All standard sizes and lengths available for immediate delivery.

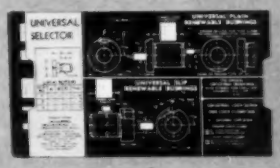
100% concentricity and hardness tests insure accuracy.

Knurled heads provide good grip.

Write for free catalog describing Standard Drill Bushings, Standard Collet Chucks, Floating Collet Chucks, Boring Chucks, Kwik-Switch Tool Holders, Mikro-Lok Boring Bars, Index Plungers and other Universal Products.

Superfinishing of Universal Drill Bushings is an important factor in keeping tool and bushing wear to a minimum . . . especially in close tolerance work. Blended radius helps prevent tool hang-up.





The Universal Drill Bushing Slide Chart gives accurate engineering data for the selection of all types and sizes of drill jig bushings up to 1¾" drill size. Request your calculator—free—on your company letterhead.

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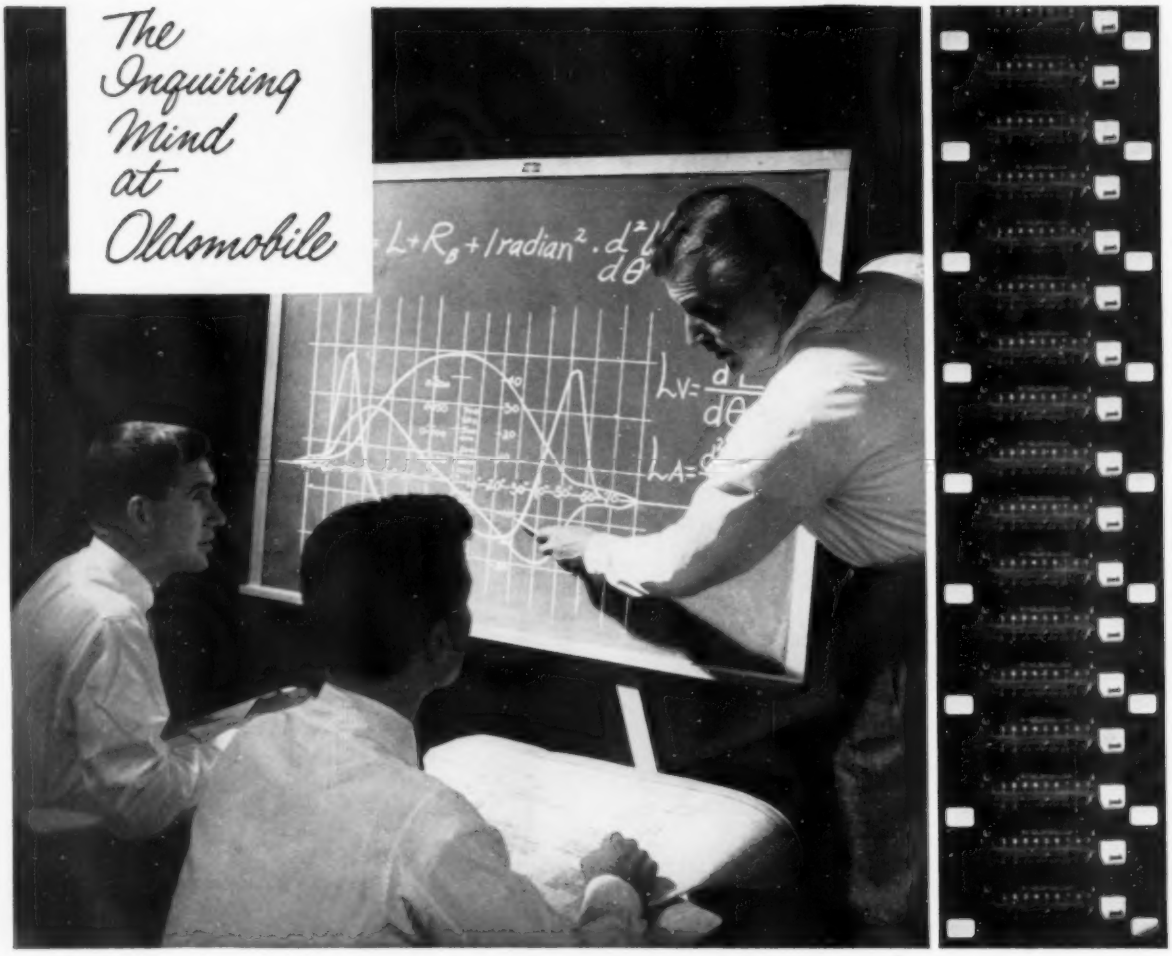


no. 1 OF A SERIES

FORMULA FOR A NEW BABY OF OURS

High speed photography helps Oldsmobile engineers translate the theory of camshaft design into practical reality.

Developing the "brains" of an engine—its camshaft—demands engineering skill of a high order, both in theory *and* practice. Advanced techniques of precision measurement guide Oldsmobile engineers in creating a profile design of optimum efficiency.

To determine exactly what happens in a valve train system, movies are taken at speeds up to 15,000 frames per second. The valve train under study is assembled in an engine block and driven by an electric dynamometer at precisely controlled speeds. A vernier scale, silver soldered to the valve spring retainer, is photographed as it moves with the valve's opening and closing.

Essentially, these photographs act as an analog computer. Analysis gives a plot of the actual "lift curve" of the camshaft—the exact linear movement of the valve at each degree of camshaft rotation. It tells at what points the valve opens and closes and also whether the valve lifter is following the cam as it should. This curve, compared to the theoretical lift curve is a definite point for refining to begin—to make sure that design theory will be production practice. With this exact and rapid technique of analysis, as many as 50 experimental camshafts may be tested before a final design is fixed.

The Inquiring Mind at Oldsmobile is never at rest in its attempt to build the best engineered car in the industry. Test drive the '58 Oldsmobile and you'll find it's the finest product in our 60-year history.

OLDSMOBILE DIVISION, GENERAL MOTORS CORP.

OLDSMOBILE

Pioneer in Progressive Engineering ... Famous for Quality Manufacturing

No. 6 in a series

You send print to Cone

Cone makes recommendations

Cone submits samples of your work

You get demonstration of your work and complete job development record

There is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

DATA FOR COMPARISON

Part	Bushing	Length	5/8"
Machine	1 5/8" Conomatic	Hole Dia.	1 1/4"
Tools	100% Carbide Tipped	RPM	825
Material	8620	Time	14.8 Secs.
Stock Size	1 5/8"		

Conomatic

For particulars send for "Four Steps With Cone"

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-229

PAID OFF in 13 weeks

JOB: Smoothing edge of plate after flame-cutting. Grinding time with tool formerly used—*2 hours.* Rotor Application Engineer recommended the *right tool*—a Rotor B-7SS* Vertical Grinder and Sander.

RESULT: Grinding time now 1½ hours—a savings of $20.25 per 40-hour week. Fast, light (6¼ lbs.) Rotor B-7 gives better finish, reduces operator fatigue.

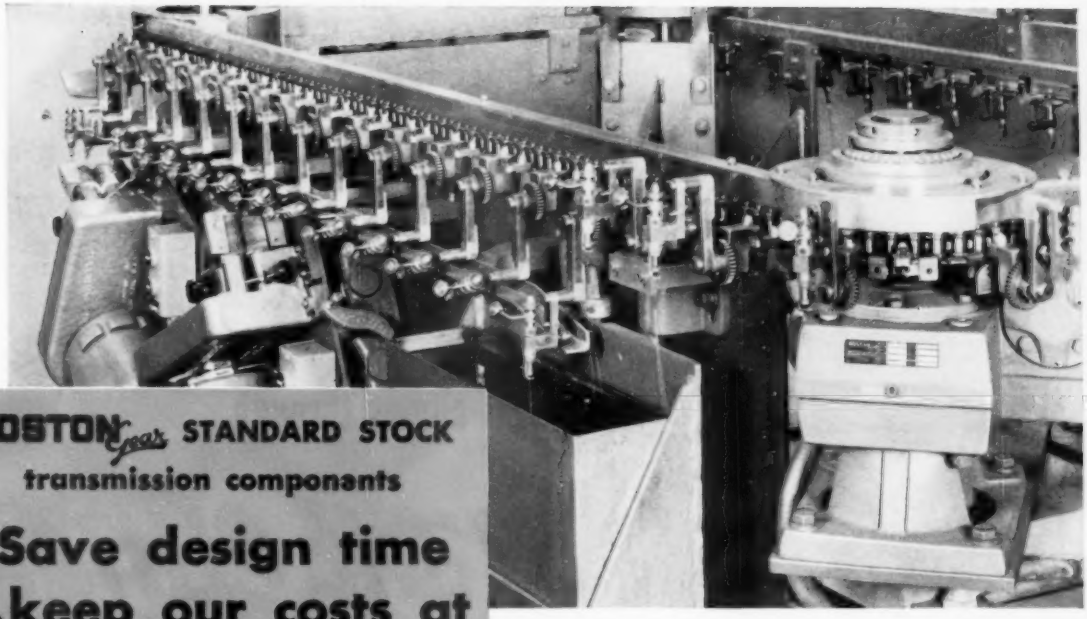
ASK FOR DEMONSTRATION of this lightweight, power-packed grinder or other Rotor Tools for *your* jobs. Write for Bulletin 56 on Vertical Grinders. The ROTOR TOOL Company, Cleveland 32, Ohio.

*B-7 with Safety Snap Throttle Handle

Here's the RIGHT TOOL for YOUR job!

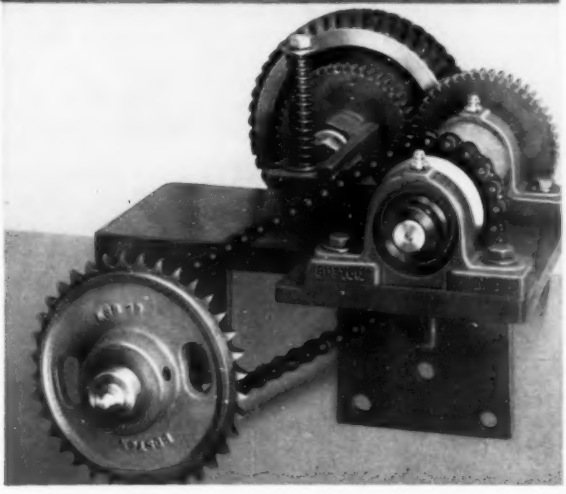
Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders
Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
Rotor High-Cycle Electric Tools: Grinders • Polishers • Sanders

ROTOR TOOLS
CLEVELAND, OHIO



BOSTON Gear STANDARD STOCK transmission components

"Save design time ...keep our costs at lowest level"



THIS SPECIAL MACHINE, *(above)* is built by the Eraser Co., Inc., for automatically stripping and soldering fuse plug lead wires. It requires the highest standards of precision and performance in all components. Assembly includes BOSTON gears, rack, pillow blocks, pulleys, sheaves, and bushings, — also the BOSTON Ratiomotor shown at the right. Manufacturer says — "In designing special machines, we use standard stock parts wherever possible. They save design time and keep our manufacturing costs at the lowest possible level."

THIS DRIVE for a rotary nylon bristle brush *(left)* is a component of an over-feed device for tentering frames made by Marshall & Williams Corp. This manufacturer of textile finishing equipment knows the many advantages of "Design around BOSTON Gear". The standard gears *(laminated phenolic)*, sprockets, chain, and pillow blocks used are all supplied from local Distributor's stock.

Design around BOSTON Gear from simple drives to full automation —

— STANDARDIZATION PAYS —

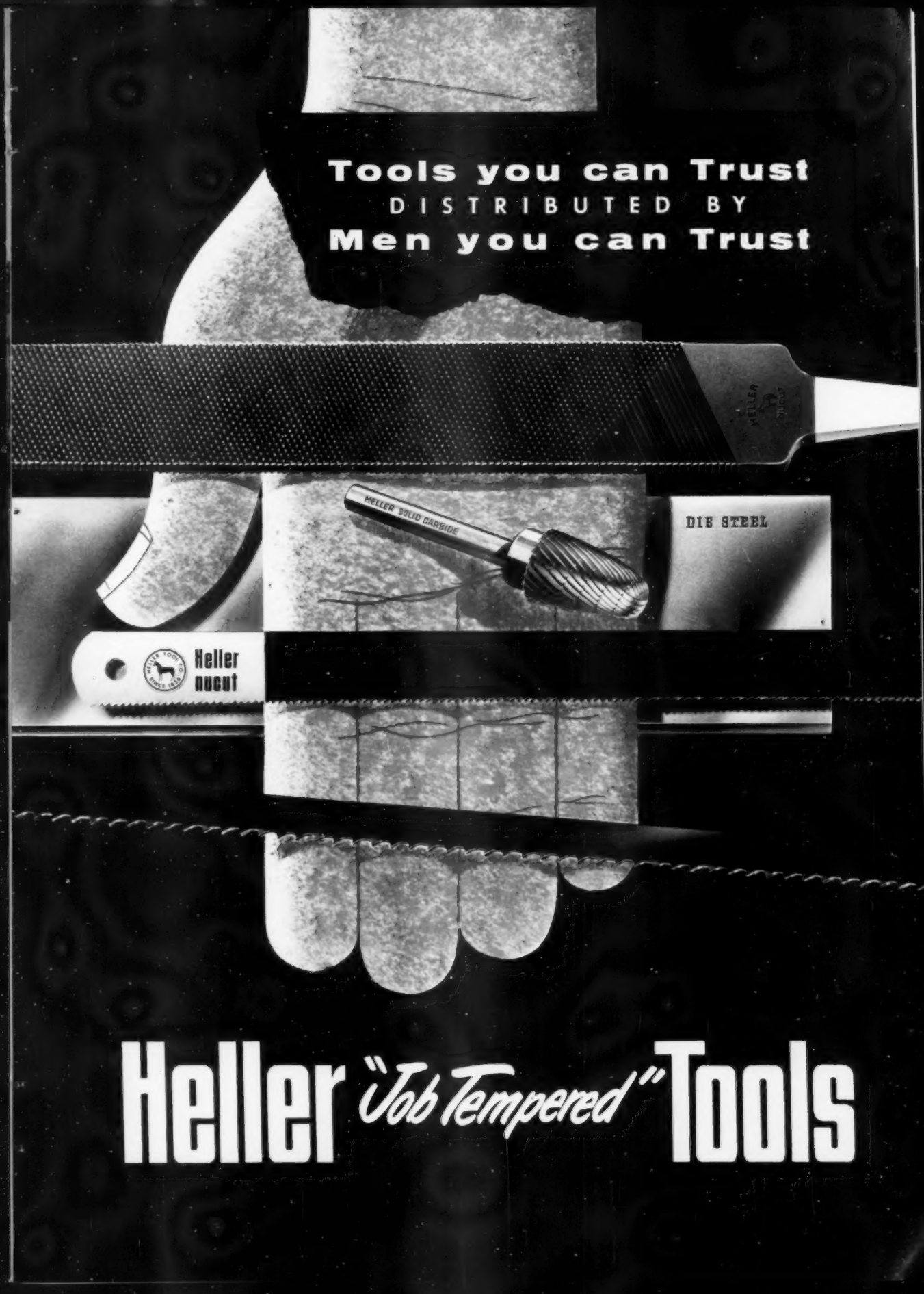
BOSTON Gear now offers more products than ever to meet any drive need, quickly obtainable "off-the-shelf" from local stocks. Your BOSTON Gear Distributor will help you simplify planning, and show you how to get the maximum benefits from standardization — in lower costs, in easier maintenance, in simplified servicing. Boston Gear Works, 83 Hayward Street, Quincy 71, Mass.

CALL YOUR BOSTON Gear DISTRIBUTOR

For nearest Distributor LOOK UNDER "GEARS" in the 'Yellow Pages'

7124 STANDARDIZED PRODUCTS OFF-THE-SHELF — AT FACTORY PRICES

— STANDARD STOCK GEARS — SPROCKETS & CHAIN — SPEED REDUCERS — BEARINGS —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Men you can Trust
HELLER SOLID CARBIDE
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SUPERIOR CUTTING AT LOWER COST

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"Job Tempered"

Hack Saw Blades

JOB TEMPERING MAKES THE DIFFERENCE!
Cross-rolled steel, produced to Heller's metallurgical specifications, has the right toughness and grain structure for your cutting requirements. Unique heat-treating methods, based on Heller's 121-years experience as a manufacturer of fine-cutting tools, give each blade uniform temper . . . for trouble-free cutting and longer life.

AMERICAN STANDARDS TESTING BUREAU AGREES!
This unbiased authority certifies that all Heller JOB TEMPERED Hack Saw Blades meet their standards for superior cutting: uniform teeth . . . uniform set . . . uniform temper.

YOU CAN TRUST YOUR HELLER DISTRIBUTOR TO DELIVER THE RIGHT BLADE!
This dependable source of cost-cutting tools carries Heller's complete line of Hack Saw Blades for both hand frames and power machines.

TOOLS YOU CAN TRUST
from
MEN YOU CAN TRUST
Heller
"YOUR OUTSIDE TOOL ROOM"
SERVICE + STOCKS = SAVINGS

HELLER TOOL CO.

HELLER TOOL CO. SINCE 1856

America's Oldest File Manufacturer
NEWCOMERSTOWN, OHIO
Subsidiary of Simonds Saw and Steel Co.

New Economy and Speed in Tooling Production for the Airframe Manufacturer with POLYTOOL

Photos courtesy of Arrowsmith Plastic Tooling, Inc., Los Angeles, Calif.

RCI EPOXY PLASTIC TOOLING COMPOUNDS

In the photos above you see a completed plastic stretch die and the laminating build-up stage in its fabrication.

This plastic stretch die has excellent dimensional stability. It is lightweight and was produced fast at low cost.

Reichhold, a basic manufacturer of resins, offers you a full line of epoxy plastic compounds for tool production.

POLYTOOL 2501 (white finish) and **2551** (metallic) are epoxy plastic tooling compounds for casting and laminating applications.

POLYTOOL 2502 (white finish) and **2552** (metallic) are epoxy plastic tooling compounds for gel coat application.

Reichhold supplies low irritation **POLYTOOL HARDENERS** for varying the gel time of these compounds. Reichhold also furnishes POLYTOOL compounds for a 3-component system with which you can vary working properties to meet specific requirements.

Why not investigate the **RCI POLYTOOL** line of plastic tooling materials? It includes not only epoxy, but also polyester, phenolic and polyurethane resin systems. RCI offers you outstanding quality control of these materials.

REICHHOLD

Synthetic Resins • Chemical Colors • Industrial Adhesives • Phenol
Hydrochloric Acid • Formaldehyde • Glycerine • Phthalic Anhydride
Maleic Anhydride • Sebacic Acid • Ortho-Phenylphenol • Sodium Sulfite
Pentaerythritol • Pentachlorophenol • Sodium Pentachlorophenol
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REICHHOLD CHEMICALS, INC.,
RCI BUILDING, WHITE PLAINS, N.Y.

Creative Chemistry... Your Partner in Progress

RCI

CLAUSING COLCHESTER GEARED-HEAD LATHES LEAD THEIR FIELD IN CAPACITY—PERFORMANCE—VALUE

The statement of Aerodyne Manufacturing Company, above, is typical — users everywhere report Clausing geared-head lathes lead their field in capacity, performance and value. Here's why:

THEY'RE BIGGER IN CAPACITY than other lathes in their class. Larger spindles, larger thru-hole capacity, larger bearings for heavier work. (See chart at right.) Geared-head drive is powered by one or two speed motor thru multiple V-belts.

HAVE HEAVY-DUTY CONSTRUCTION THROUGHOUT. Beds are 50% steel, 50% iron with elliptical cross ribbing — ways are induction hardened and precision ground. Gears in head and quick-change box run in bath of oil — gear shafts are multi-splined. Power feeds are taken from separate feed rod, lead screw is used for thread cutting only. Spindles are high-tensile hammered steel forgings — note size. Note, too, the heavy-duty construction of tailstock and double-walled apron.

BUILT FOR PRECISION PERFORMANCE — to American standards of toolroom lathe accuracy. Gamet Micron tapered roller bearings with oil flow lubrication — the most advanced and accurate bearings known to industry. And each Clausing lathe passes rigid tolerance tests before it leaves the factory.

EACH IS AN OUTSTANDING VALUE. 13" cabinet base models, including motor and controls, start at $2113; 15" cabinet base at $2988; 17" at $4715. You owe it to yourself to investigate before investing in *any* lathe.

LATHE CAPACITIES

17" lathe: 54" and 78" centers, 28" swing in gap; 15" lathe: 30" and 48" centers, 24" swing in gap; 13" lathe: 24" and 36" centers, 18" swing in gap.

SPINDLE CAPACITIES

Lathe	17"	15"	13"
Thru-Hole	3-1/16"	2-1/16"	1-9/16"
Nose Taper Key Drive	L-2	L-1	L-0

BEARINGS

Lathe	17"	15"	13"
Front Spindle Bearing O.D.	7-1/2"	5-1/2"	4"
Rear Spindle Bearing O.D.	6"	4-3/8"	3-9/16"

CLAUSING DIVISION

Write for Free Literature

ATLAS PRESS COMPANY

2-114 N. PITCHER ST. • KALAMAZOO, MICHIGAN

The FEDERAL DIMENSIONAIR

No adjustment diddling. Set this gage quicker than you can set your watch. Once set, it *stays* set! *It can't drift.*

No need to keep a stockpile of dials. This 7½" *accurately calibrated, all-usable* scale will answer every normal gaging need. Operator cannot change magnification or monkey with your tolerance specifications. Dimensionair is foolproof. To meet the occasional finer or coarser measuring requirements, other magnifications are available.

NOTE: Accurate setting is guaranteed with one master. However, the Dimensionair can be used equally as well *with two* if your standards so specify.

Finger tip attachment. *Longer approach range* lets you see where you are going. *Greater plug clearance* for faster, easier gaging — less wear: No scoring or jamming. *greater exploration* of out-of-round, taper, irregularities. No centralizing error. Deep-set air jets give *longest useful life;* large and *self-cleaning, jets* clean work while they gage.

With this air gage you will measure

More Accurately

More Dependably

Faster
(Greater Plug Clearance)

With Less Maintenance Cost

With Less Dependence on Skilled Help

than with any other air gage you can buy!

This is a statement we are ready to prove. Don't take our word for it. *Try* the Dimensionair on a "no-strings-attached" trial basis. Mail the coupon today.

Ask FEDERAL *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

mail coupon today

Federal Products Corporation
8192 Eddy Street · Providence 1, R. I.

OK Prove it! ***Let us try a DIMENSIONAIR***

Name _____

Company _____

Address _____

General Mills said it about the Lindner Optical Jig Borer

"Machine time on the Lindner was 32 hours. Estimated time on any other machine or combination of machines in the shop was at least 64 hours, with serious doubts that the quality would have been as good."

The Job:

Machining an optical test fixture for checking the hemisphere sight for the MD-9 Tail Defense System, used in the B-52 Bomber.

The Specs:

1) Locating and boring bearing holes to +.0002, −.0000; 2) Locating and boring 49 additional holes for mounting optical lenses; 3) Milling a flat surface with first class microfinish around each hole to an angular position within ±2 minutes.

The Machine:

Lindner Optical Jig Borer, Model LB15A, with preselective Autopositioner®, used throughout for all locating and machining.

need we say more?

Learn why Lindner Optical Jig Borers have changed so many ideas about jig boring. Send for a 25-minute movie film demonstration without obligation

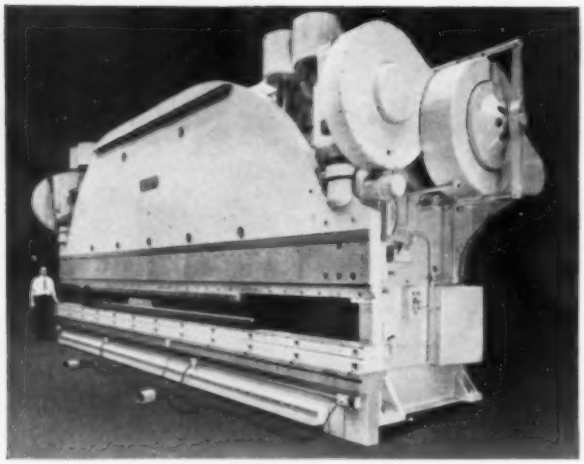
Lindner Optical Jig Borers are available in two models: LB15A with Autopositioner—Table size 44" x 24"; LB14—32" x 16" (without Autopositioner)

KO CO., INC. PRECISION MACHINERY

KURT ORBAN

COMPANY, INC.

Harborside Terminal Bldg., Jersey City 2, New Jersey



How press brake construction affects job costs

Only accurate machines can make accurate bends. The accuracy obtainable from a press brake begins with its structural rigidity. Cincinnati Press Brakes give you maximum accuracy and rigidity because of these construction features:

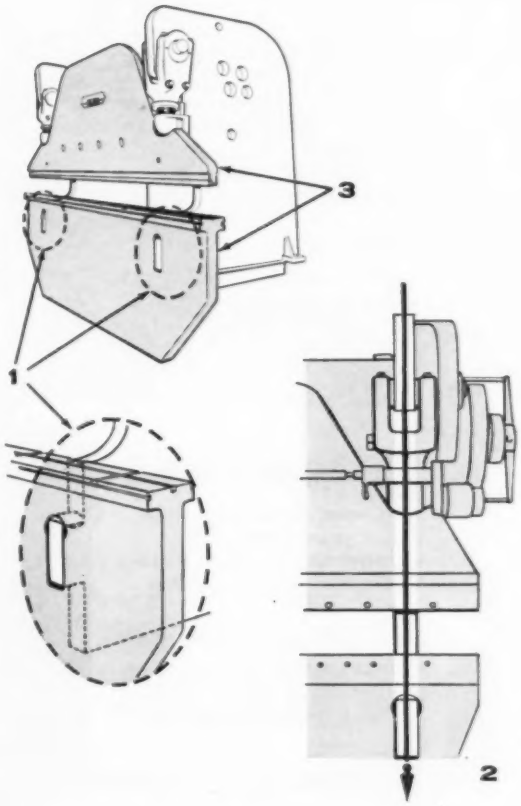
1. Interlocked construction—The bed is supported directly by the housings, by means of hand-scraped bearing shoes. No welds are used as load supports, so every Cincinnati is free from welding strains.

2. Center line loading—Since the Pitmans which drive the ram *straddle* the housings, weaving of the frame and cramping of the ram slides and shaft bearings is eliminated. All operating forces are contained within the housings.

3. Deep beds and rams—It's a simple engineering fact that the rigidity of a press brake's ram and bed increases approximately as the cube of the depth. For this reason, most of the weight of the ram and bed of a Cincinnati Press Brake is disposed in depth, rather than thickness. Tests prove their working surfaces remain parallel within .005" under capacity loads.

To you these construction features mean money saved in the long run. A Cincinnati Press Brake is more accurate than other makes when you buy it . . . and will stay that way throughout its long life.

Write department E for Catalog B-5.



Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

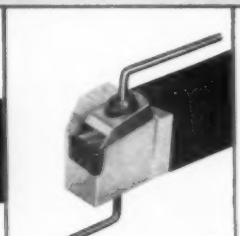
Cincinnati 11, Ohio

ADAMAS DEX-A-TOOL cuts machining costs

Only Dex-A-Tool gives you all 10 modern design features . . . features that mean faster set-up, closer tolerances, fewer parts, and less downtime.

Fully adjustable chipbreaker . . . in increments of .030". Insures excellent chip control. One piece positive locking. No wasted machine time changing non-adjustable chipbreakers to get proper chip control.

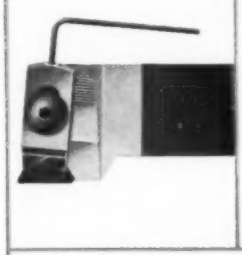
Extra thick carbide anvils . . . thickest shank-supported anvils in the industry. The thick anvil in Dex-A-Tool gives more rigidity to throwaways and provides the ideal platform for maximum insert performance.



Easy indexing . . . clamp locking screw may be loosened from bottom as well as top. Simplifies insert indexing when holder is upside down.

Holds both "thick" and "thin" inserts . . . allows you to utilize economical thin inserts (⅛") wherever possible and still maintain the advantage of switching to thick inserts (3/16") whenever necessary.

Chipbreaker Clamp Faced with Thick Carbide . . . provides much more wear resistance than thin carbide coating or cast alloy clamp.

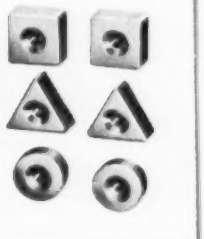


Setscrew chipbreaker clamp . . . permits fast positive resetting of chipbreaker after insert indexing. Nylon plug engages the setscrew and prevents any loosening of setscrew.

Combination chipbreaker — clamp . . . single unit construction means no loose chipbreakers to fall out. Inventories reduced. Simpler use gives a savings in production time.

Anvil invertible as well as indexable . . . extra thickness of anvil allows countersinking of both sides. This permits anvil to be inverted for extra life.

Special high temperature brazing alloy . . . used in brazing carbide chipbreaker to clamp. Prevents braze failure during high machining temperatures.



Carbide or steel anvils . . . your choice of carbide or copper plated hardened high speed steel anvils.

No other toolholder has fewer parts than Adamas Dex-A-Tool . . . none are easier to operate. Dex-A-Tool's features add up to more production per insert corner. Measure this extra savings on your own machines . . . plan a test of Adamas Dex-A-Tool today!

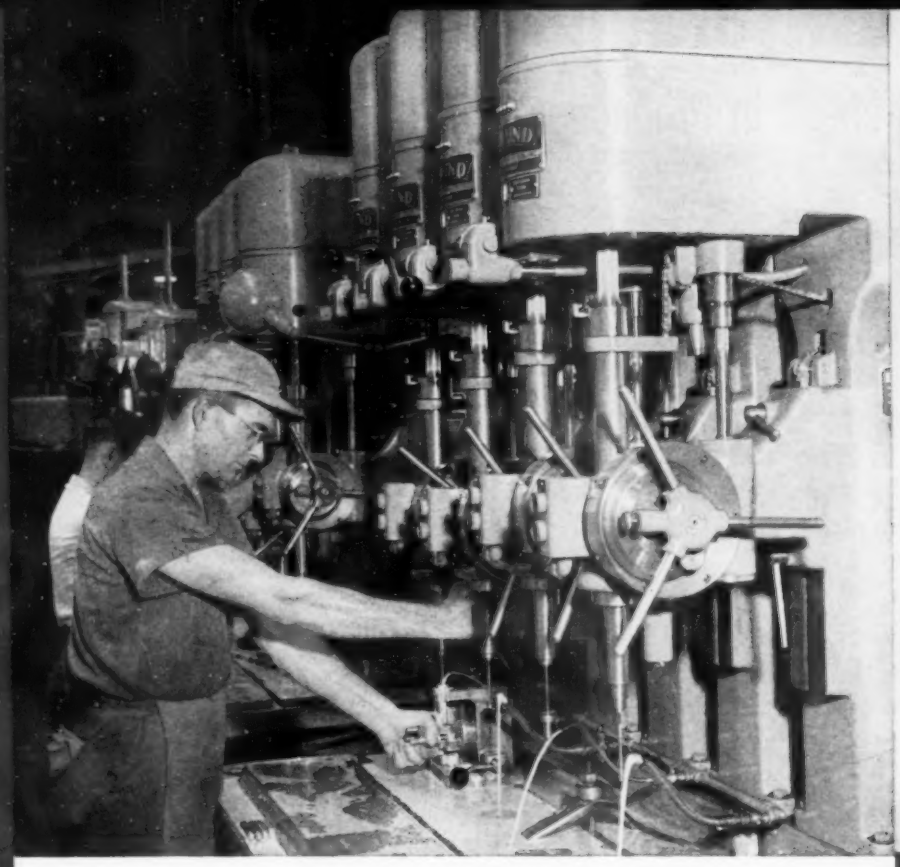
For additional Dex-A-Tool literature, an actual demonstration test, or a free copy of "Throwaway Tooling Set-up and Follow Thru" write: Dept. 261

ADAMAS
CARBIDE CORPORATION, KENILWORTH, N. J.

PRODUCERS OF TUNGSTEN CARBIDE TOOLS, TOOL TIPS, DIES, WEAR PARTS, DEX-A-TOOL AND CERALOX.

Team Dex-A-Tool with Adamas throwaway inserts and gain top performance under varying machining conditions . . . top performance possible only through Adamas wide range of quality controlled grades.

CATERPILLAR CHOOSES EDLUND



IMPROVED QUALITY

GREATER ECONOMY

INCREASED EFFICIENCY

Edlund 2F Drilling and Tapping machines in Caterpillar's Peoria Plant.

Dependable, rugged Edlund Drilling and Tapping machines meet the challenge of Caterpillar's exacting demands for better methods of manufacture. For drilling, reaming, chamfering operations these power-packed Edlund machines furnish constant, trouble-free service, reduce "down-time" to a minimum and require only routine maintenance.

Model 2F Features: **Top production machine for medium to heavy drilling and tapping. Infinitely variable speeds to 3600 rpm**
8" - 12" - 15" Overhang
1¼" Capacity
Write for Bulletin 140R

Also Model 1F with Infinite speeds to 10,000 rpm and
⅜" capacity.
Write for Bulletin 160.

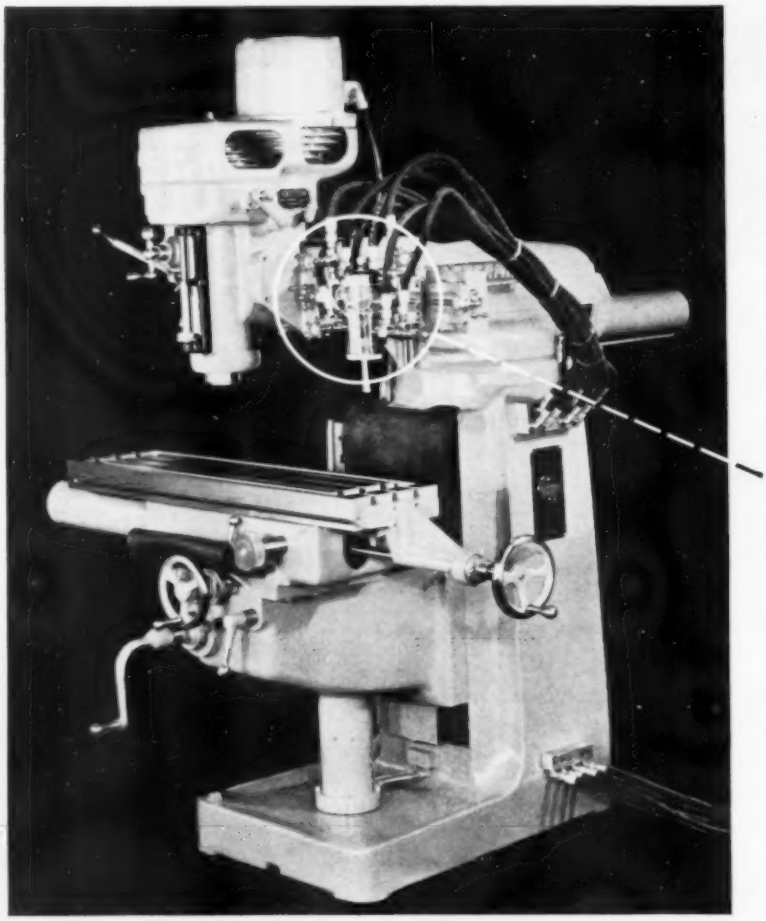
And Model 4F with Infinite speeds to 2200 rpm and
1¾" capacity.
Write for Bulletin 170R.

EDLUND REPRESENTATIVES IN MAJOR CITIES

EDLUND
MACHINERY COMPANY
Cortland, New York
Division of Harsco Corporation

Now "Micrometer Accuracy" Applied to Hydraulic Tracer Control

Provides more speed in Production Profiling and Duplicating



Gorton Trace-Master Hydraulic Tracer control is today's best unit for 2- and 3-dimensional duplication, production profiling and work on all types of die forging, die casting, metal stamping, embossing and coining, as well as plastic molds in both ferrous and non-ferrous materials.

GORTON

"TRACE MASTER" Supersensitive Hydraulic Control

This master control valve is manufactured to tolerances which are NEW in the field of hydraulics. Working parts are so delicately ground and lapped that they will operate only with a very fine grade of special oil. *Ordinary hydraulic fluids are wholly unsuitable.*

3 MODELS AVAILABLE

180° Vertical Hydraulic Feed to Knee.

360° Cross Hydraulic Feed to Ram and Longitudinal Hydraulic Feed to Table.

3D Hydraulic feed to knee, ram and table for 3-dimensional work.

The above can be furnished with the Gorton 1-22 Mastermil illustrated here or the Gorton 9-J Super-Speed Vertical Mill with single spindle, twin spindles and/or six inch higher column for additional vertical capacity.

Write for complete information contained in bulletin 2771-2602.

GORTON

GEORGE GORTON MACHINE CO.

2602 Racine Street — Racine, Wisconsin

SINCE 1893

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

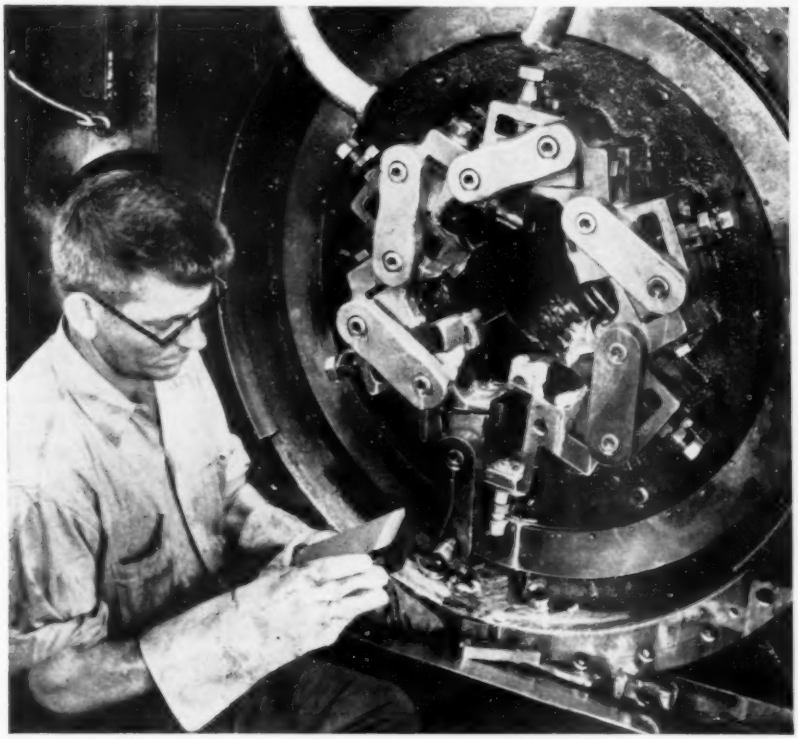
A7-1002-1P

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



Nickel Billets Get Close Shave with Tools of 66 High-Speed

Biting into billets, castings or forgings of nickel or nickel alloy is one of the toughest assignments ever devised for tool steel. And yet, such jobs are taken in stride with Bethlehem high-speed tool steel at the plant of International Nickel Co., Huntington, W. Va.

Bar peeler cutters, made of 66 High-Speed tool steel, prepare nickel surface for extrusion.

The bar peeler cutters, in the picture above, are hardened to Rockwell C 60-62, and are used in the surface preparation of nickel billets, prior to extrusion. Despite this extremely rugged operation, the cutters are doing an outstanding job, because of their unusual resistance to shock and wear.

66 High-Speed is ideal for all types of cutting applications because of its well-rounded 6-5-4-2 analysis. In addition to its outstanding shock and wear properties, it has excellent red-hardness and abrasion resistance — all the qualities needed for satisfactory high-speed cutting work.

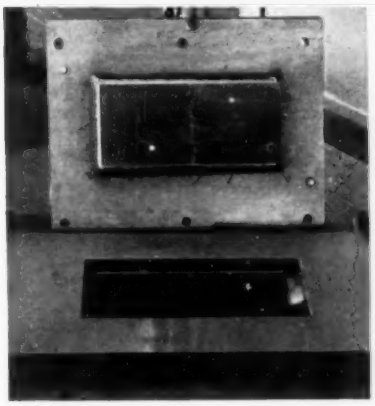
If you would like to learn more about 66 High-Speed, and the many jobs it can handle, simply get in touch with your friendly Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Overloading of Machines Shortens Tool Life

Overloading of machine tools is detrimental not only to the machines, but also to the life of the tools. Overloads cause excessive deflection of the constructional members, which may cause misalignment of mating tools and change calculated clearances. This in turn may produce excessive wear on the tools, and may result in defective parts or premature tool breakage.

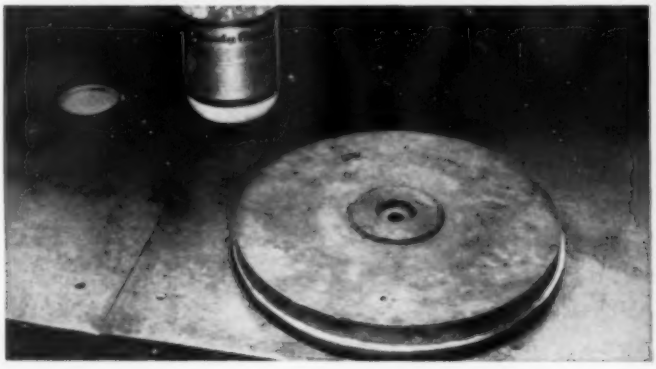
Overloading frequently results from performing an excessive number of operations at one time, such as multiple piercing of holes. Overloads of this type can be prevented without changing the work to be done by providing, (1) shear on either the punch or die to reduce the maximum punching load, or, (2) by staggering punch heights so that the multiple operations are performed in sequence, instead of all at the same time.

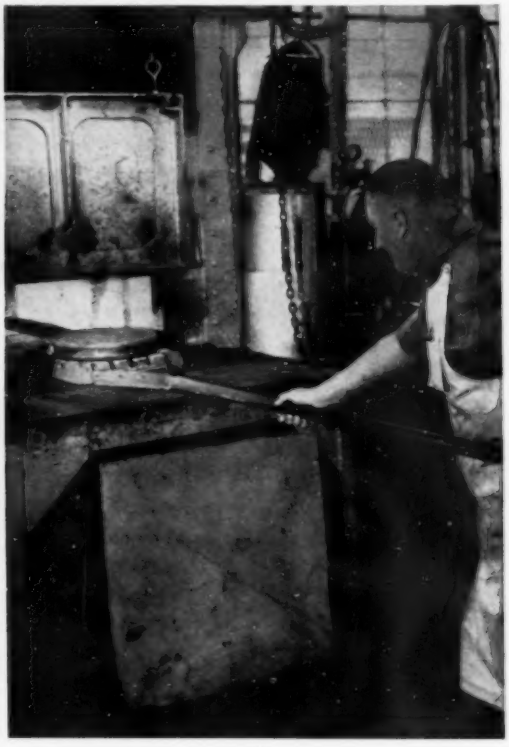


UP TO 30,000 CONVEYOR PANELS WITH DIE OF 67 CHISEL

This large blanking die was employed in the production of conveyor panels, made from 14-gage sheet steel. It was hardened to Rockwell C-50, and turned out as many as 30,000 pieces before redressing was required. 67 Chisel is our popular chrome-tungsten type of shock-resisting tool steel. In addition to its use in blanking, it's excellent for hot-work tools, shear blades, and swaging dies. Give it a try.

Insert halves are first carefully cleaned and fluxed. The sheet of EASY-FLO, .005" thick, in three sections, is liberally fluxed with HANDY FLUX. Following this, the halves are put together with EASY-FLO as a "sandwich filler" (below, left). Entire assembly is heated to a brazing temperature of 1170° F.





How EASY FLO Helps COLUMBIA RECORDS make records

EASY-FLO is put to excellent use in the die inserts (or backing plates) used in the manufacture of Columbia Records at the company's Bridgeport, Connecticut, plant. These die inserts are the heating and cooling elements used in the actual plastic record molding; in a very real sense, they are *behind* the entire record-making operation. The die insert assembly consists of two steel plates, the bottom plate being grooved to permit the passage of steam, at a temperature of 300° F under a pressure of 130 lb., followed by cold water at a pressure of 120 lb. When joined, they must be absolutely leak-tight and strong enough to stand up under thousands and thousands of stampings through drastic temperature changes and thermal shock.

These brazed backing plates have a life cycle of some 250,000 records; they are usually retired because of warpage in the steel, rarely for joint leakage.

This example illustrates just a few of the qualities that make silver brazing such a superior joining method. Strength under high pressure, resistance to temperature changes and thermal shock, and production ease; one, or all, of these qualities may apply to your product or production operation. We will be happy indeed to show you how you can benefit from this blue-ribbon method of joining all kinds, shapes and sizes of metals—similar and dissimilar. BULLETIN No. 20 will get you off to a good start on the values, techniques and economies of low-temperature silver brazing. Write for your copy.

Your NO. 1 Source of Supply and Authority on Silver Brazing Alloys

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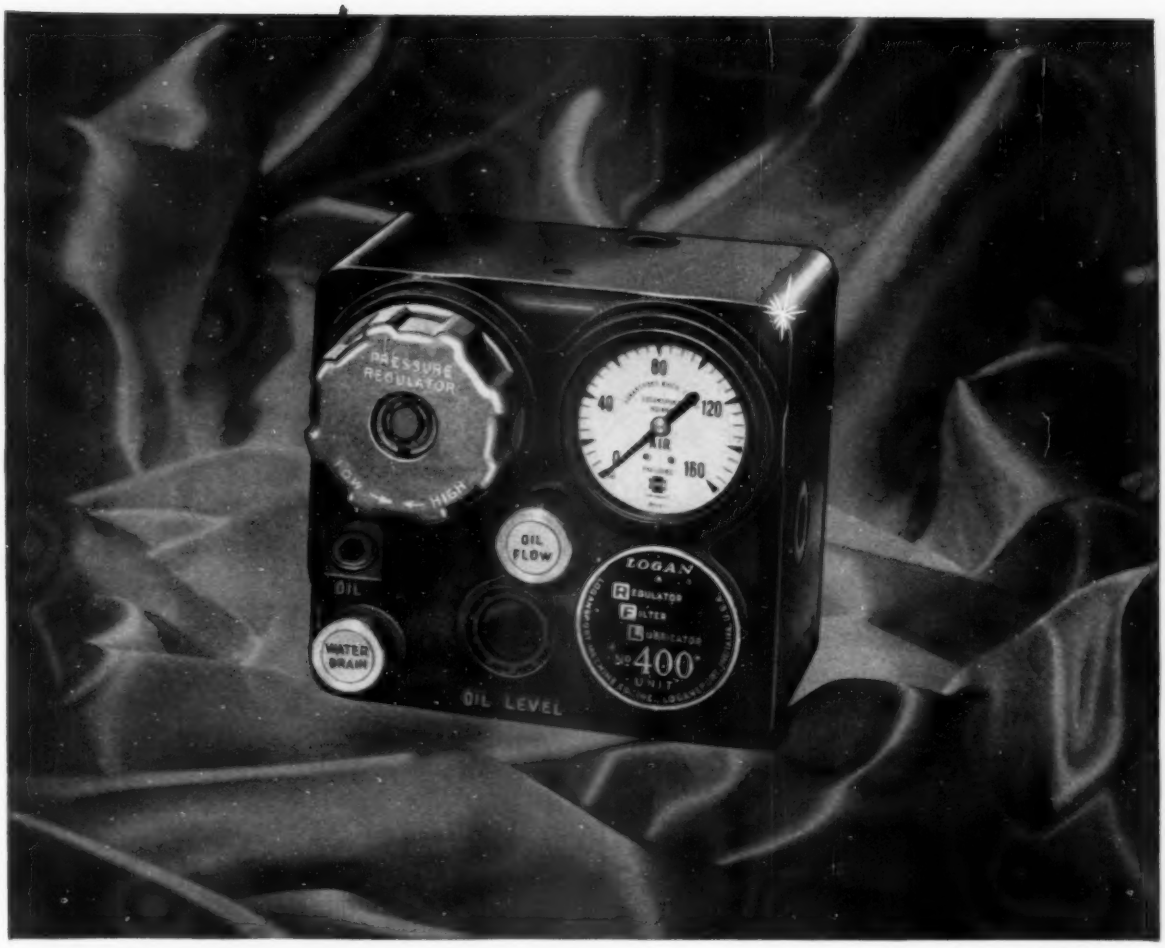

Illustrated—Logan Model 400 RFL Unit

Look to Logan

the ultimate in air circuit accessories

Logan RFL Unit, the designers choice for over a decade! Protects your air-powered equipment . . . regulates pressure . . . filters air . . . lubricates air. Adds years of dependable performance.

New Model 400, illustrated above, is a companion model to the well-known Model 600.

FREE SEND FOR THE "LOGAN CALCULATOR"

MEMBER: Natl. Mach. Tool Builders' Assn.; Natl. Fluid Power Assn.

LOGANSPORT MACHINE CO., INC.
839 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ 100-1 AIR CYLINDERS
- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-5-1 ULTRAMATION CYLINDERS
- ☐ 300-2 PRESSES
- ☐ FACTS OF LIFE
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
- ☐ 200-3 750 SERIES HYD. CYLINDERS
- ☐ 200-4 and 200-7 HYD. VALVES
- ☐ 200-6 SUPER-MATIC CYLS.
- ☐ 300-1 CHUCKS
- ☐ ABC BOOKLET
- ☐ CIRCUIT RIDER

TO:

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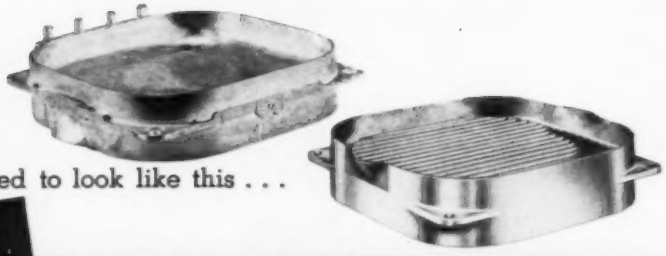
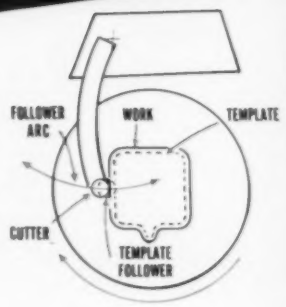
when you have parts of aluminum or other nonferrous metals . . .



that must be side, face or contour milled to look like this . . .

You can do the job better, far faster and at much less cost with an Onsrud® **ROTARY FEED HIGH SPEED MILLING MACHINE**



Guide roller mounted on pivoted arm follows template, moves to any point of follower arc to vary cutter head position as required, as table rotates to feed work through complete milling cycle.

WORK SET-UPS LIKE THESE . . . PART OF THE PRODUCTION ADVANTAGES OF ONSRUD ROTARY FEED MILLING

ALL FOUR SIDES IN ONE SET-UP
Work held by pneumatic cowler clamp, for milling completely around the part if desired.

CONTINUOUS PRODUCTION
Work fixture built with two, three or four (or more) stations for continuous feed of work to cutter. Operator merely loads and unloads without production time loss.

ONSRUD
MACHINE WORKS, INC.
MACHINE TOOL DIVISION
7726 LEHIGH AVENUE — NILES 31, ILLINOIS
(SUBURB OF CHICAGO)

Here is one of several Onsrud Rotary Feed Milling Machine models . . . a design type that has become the most versatile and productive in metal milling. The kinds of production parts that can be milled to advantage are almost endless in number . . . wherever the operation involves straight line or contour side milling or horizontal top-edge milling. The A-50AE machine shown here has a capacity for work up to 40" diameter. A high speed milling head with Onsrud two speed 7½/3¾ HP, 3600/1800 RPM air cooled motor gives proper cutter speed for fine finish and rapid feed. Other models supplied to fit work requirements as needed.

Write for Information

Let us tell you how Onsrud Rotary Feed Milling Machines can lower your production costs . . . in aluminum and related nonferrous milling. We'll also be glad to give you information on all other Onsrud milling machines for every type of production milling. Your inquiry is cordially invited.

Onsrud® High Speed **MILLING MACHINES** for Aluminum and Related Nonferrous Metal Milling

For doing things *better* by doing things *differently!*

NICE BALL BEARING Company

NICE
TRADE MARK
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IMPORTANT NOTICE!

NICE ANNOUNCES ITS APPOINTMENT AS THE SOLE LICENSEE IN THE UNITED STATES FOR THE MANUFACTURE AND SALE OF THE MOST AMAZING BEARING IT HAS EVER WITNESSED. IT FEATURES A SOLID INNER AND SOLID OUTER RACEWAY, WITH DEEP, UNBROKEN BALL GROOVES *AND A FULL COMPLEMENT* OF BALLS. A BALL SEPARATOR MAY BE INCORPORATED, BUT IN EITHER CASE, THERE IS NO LOADING SLOT OR SPLIT RACE TO ADMIT THE BALLS TO THE BEARING. ITS ENDURANCE, IN OUR TESTS AND EXPERIENCE, IS GREATER THAN ANY SIMILAR BEARING EVER WITNESSED. NEW MANUFACTURING METHODS PROVIDE CLOSER TOLERANCES, CLOSER RADIAL AND AXIAL CLEARANCES AND IMPROVED FINISH. IT WILL BE SOLD IN ALL CASES AT VERY ATTRACTIVE PRICES, USUALLY WITHOUT COST PENALTY AS COMPARED WITH COMPETITIVE BEARINGS OF COMMERCIAL QUALITY, YET IT WILL BE A SUPERIOR BEARING. PATENTS THROUGHOUT THE WORLD ARE COVERED BY HEIM - *Unibal*®. WE PLAN TO SEE *YOU* SOON — IF WE FAIL TO SEE YOU SOON ENOUGH — WILL YOU PLEASE CALL US?

NICE BALL BEARING COMPANY
DIVISION OF CHANNING CORPORATION
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VISIT NICE BOOTH NO. 131, DESIGN ENGINEERING SHOW, CHICAGO, APRIL 14th-17th

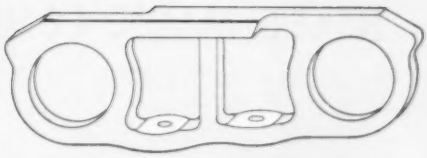
This job is a "natural" for broaching . . .

and the V-3 VERTICAL PULL-DOWN **LAPOINTE**

BROACHING MACHINE

is so efficient that it pays its way

although working only 1/3 of its available time!

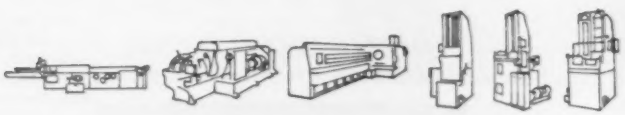


Steel forgings are tough to machine, but one of the world's largest producers of road-building equipment has substantially reduced production costs by Lapointe-Broaching the nut seats in steel-forged track links. Two 1¼" wide x 5/16" deep internal nut seats are broached in each link. Production is 170 complete links per hour, at 80% efficiency. And the interesting part of it all is that the investment in this Lapointe machine is paying off even though the broach *stands idle for two-thirds of the time!* . . . In your own shop there may be difficult operations that can be converted to Lapointe-Broaching from milling, shaping, etc., with an *improvement in quality, increased production . . . and lowered costs.* Why not invite an experienced Lapointe Field Engineer to call on you?

THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

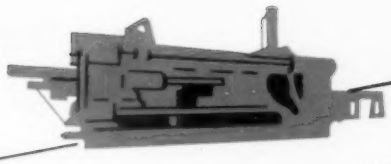
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



LAPOINTE

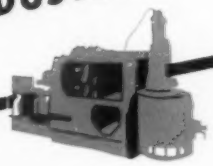
known to be the best in

BROACHING



An Announcement of Four Star Importance

TO THE HOT EXTRUSION AND DIE CASTING INDUSTRIES



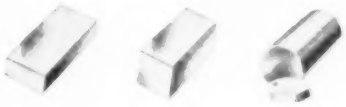
4 New MILNE Hot Work Steels

The announcement of these new Milne steels marks the most significant advance in hot die metallurgy of the past decade. These new Milne steels have unprecedented physical advantages enabling them to take thermal and mechanical punishment no other hot work steels can stand.

For major producers of hot extrusions and die castings these steels can provide "custom-tailored" routes to better tooling.

Your nearest Milne representative will be glad to give you further details, *in person*, without obligation.

Milne's new Hot Work steels are available in Rounds, Flats, Squares and in forged Blocks, Discs and Rings.



WAREHOUSES: Boston • New Britain • Kenilworth, N. J. (New York) • Philadelphia • Pittsburgh • Cleveland • Dayton, O. • Detroit • Melrose Park, Ill. (Chicago) • St. Louis • Atlanta • San Francisco • Los Angeles

SALES OFFICES: Rochester, N. Y. • Indianapolis • Louisville • Milwaukee • Kansas City, Mo. • Charlotte, N. C. • Phoenix, Ariz.

SALES AGENCIES: Maxwell Steel Co., Inc., Fort Worth, Texas • Sanderson-Newbould Ltd. (In Canada) Montreal-Toronto

Also wide range of grades and sizes in

WATER HARDENING • NON DEFORMING • SHOCK RESISTING • GRAPHITIC AND HIGH SPEED TOOL STEELS • Solid—Hollow—Flat Ground

MILNE & CO., INC.
Established 1887 — Incorporated 1937
General Offices: 67 W. 44th St., N. Y. 36, N. Y.
America's Leading Tool Steel Specialists
Complete Line of Tool Steels — HOLLOW and SOLID

Write for our new catalog section on all MILNE Hot Work Steels AM-39

M 330

A new general purpose Hot Work Steel — highly resistant to thermal shock and heat checking — has good physicals and hardness at elevated temperatures. Distinctly insensitive to water cooling. For **all types of extrusion on soft and cuprous metals. For aluminum, zinc and magnesium die casting dies.** It is weldable.

M 331

An adaptation of M 330 steel with increased carbon to provide the higher strength required by applications such as **hot extrusion dies for aluminum, magnesium etc.**

M 333

A steel with exceptional capacity for dissipating heat. The last word for **brass die casting** and for all hot work applications where rapid heat removal is vital in hard-to-cool parts.

M X-15

An extraordinarily tough steel with tremendous capacity to withstand high temperatures and pressures. Outstanding for **hot extrusion** of ferrous metals where pressures are very high and generated heat extreme.

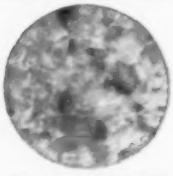
DoALL ACQUIRES WORLD'S FINEST SOURCE OF BLACK GRANITE-*DIORITE* FOR SURFACE PLATES

NO SOFT SPOTS

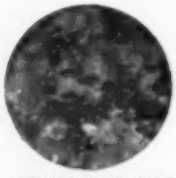
WON'T SCRATCH

BLACK GRANITE

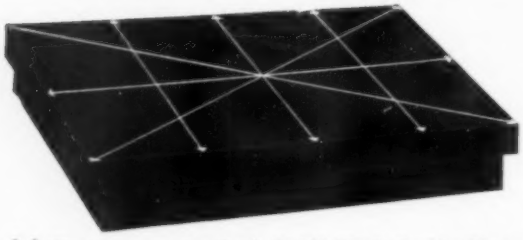
So dense and smooth a scriber can't find soft spots nor will it scratch sensitive acetate. DoALL Black Granite-Diorite is the superior material in all ways. You can see its denser grain structure, compared with pink and gray.



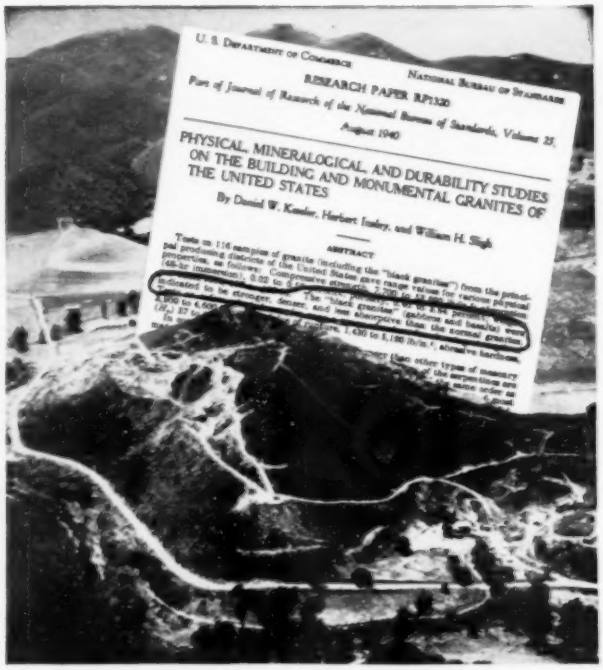
PINK GRANITE



GRAY GRANITE



A better accuracy standard. DoALL Black Granite-Diorite surface plates are specified from an over-all mean plane, not per square foot area.



Home of DoALL Black Granite-Diorite is this Quarry No. 115 near Escondido, California, which the National Bureau of Standards lists in its research paper R.P. 1320 and Fed. Spec. 666-P-463 as the source of finest Black Granite-Diorite.

SEE THE DIFFERENCE IN YOUR OWN SHOP

While granites in general are usually selected as surface plate material over cast iron, much confusion exists as to *which* granite *is the best*.

Different types of granite have varying degrees of soft spots or lack toughness and resistance to wear. Others do not have the density necessary for greatest strength and least porosity, and some types cannot be properly lapped to a fine finish. All of these factors lessen the degree of accuracy obtainable. In its search for better granites, the National Bureau of Standards Research Paper RP-1320 states: "The Black Granites (gabbros and basalts) were indicated to be stronger, denser and less absorptive than the normal granites."

By obtaining the best in granites, DoALL can impart its years of gaging experience to the manufacture of the finest in surface plates.

Take advantage of our *Free Trial* offer to find out why DoALL Black Granite-Diorite is preferred over all other surface plate material.

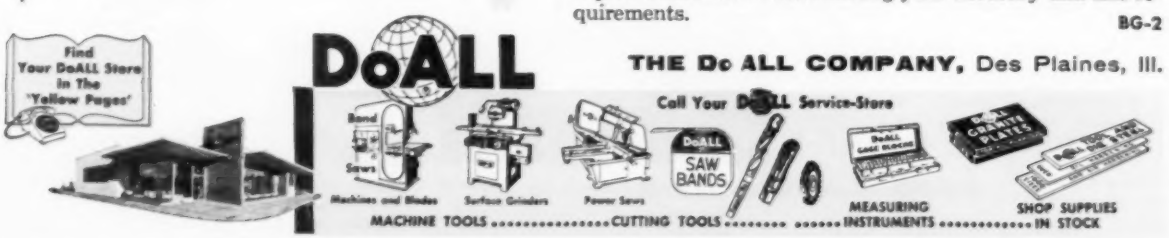
Call your DoALL Gage Specialist now; he will give you expert assistance in determining your accuracy and size requirements.

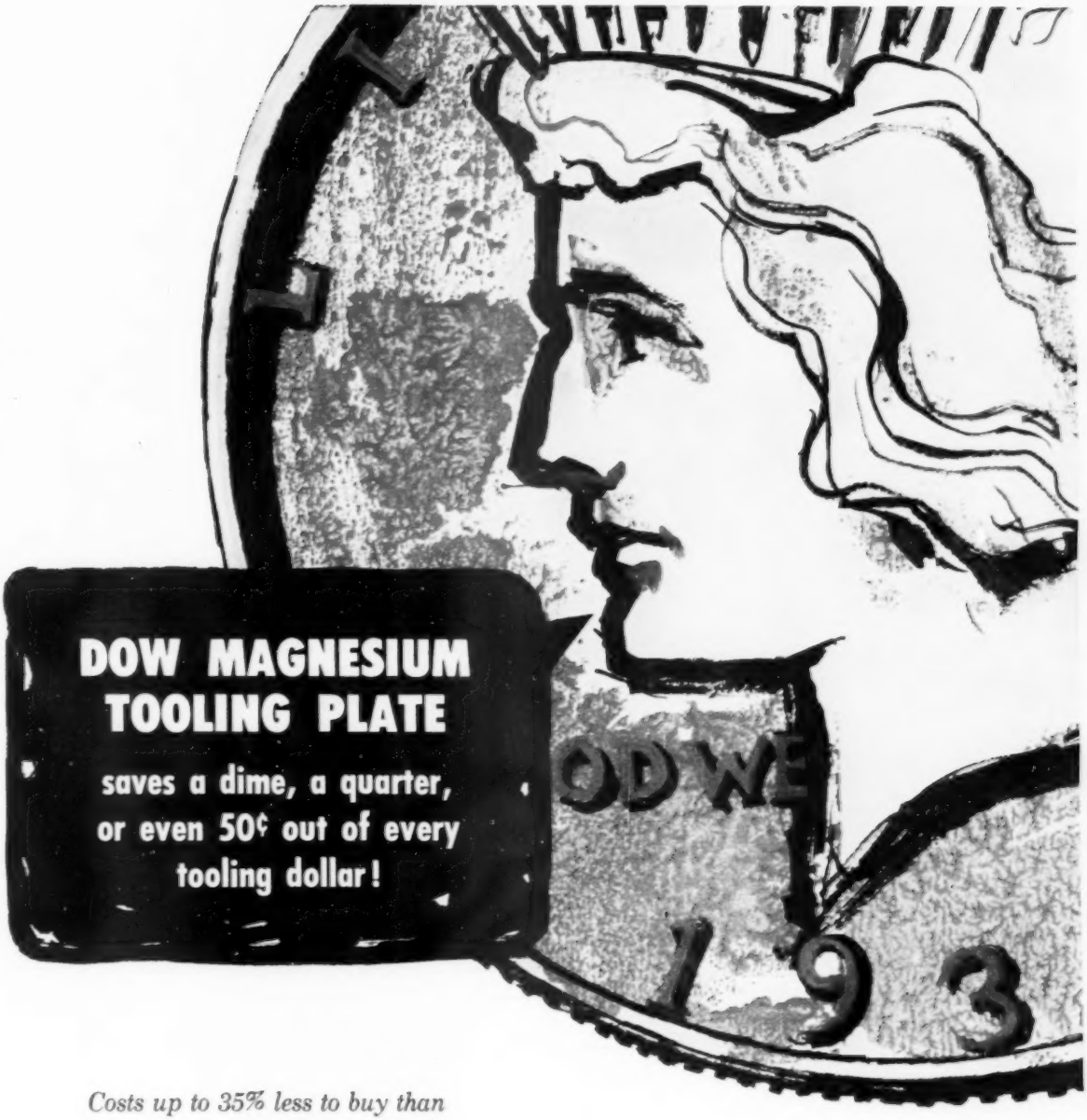
BG-2

10-DAY FREE TRIAL OFFER!

Prove for yourself in your own plant the superiority of Black Granite surface plates. We will deliver your choice from these four sizes: 8" x 12", 12" x 18", 18" x 24" and 24" x 36".

THE Do ALL COMPANY, Des Plaines, Ill.





Costs up to 35% less to buy than other lightweight tooling metals

Here's why Dow magnesium tooling plate costs less to buy. The fundamental characteristics of magnesium permit rolling and oven thermal flattening to a degree of flatness and surface smoothness satisfactory for virtually all tooling uses. This flatness is not obtainable in other lightweight tooling materials without costly machining of the surface.

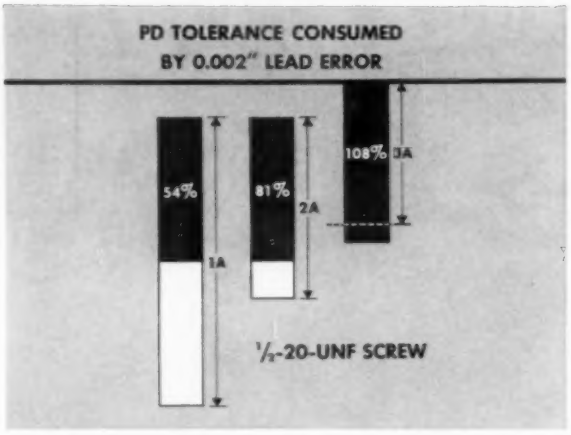
You save on fabrication costs, too. Magnesium's unsurpassed machinability saves time, effort and wear. Magnesium's lightness makes tools easier to handle during fabrication and use. Remember—magnesium COSTS LESS TO BUY, COSTS LESS TO FABRICATE, COSTS LESS TO USE!

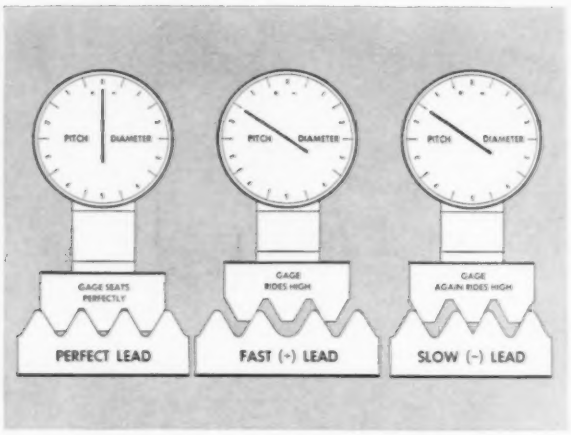
Ask your Dow magnesium supplier for the complete story. Contact him today or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 1427A.

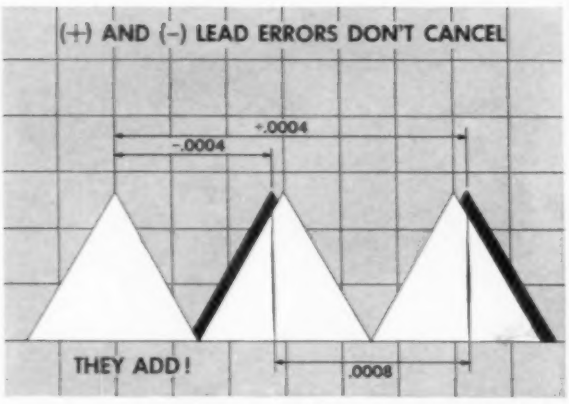
AVAILABLE FROM STOCK AT:

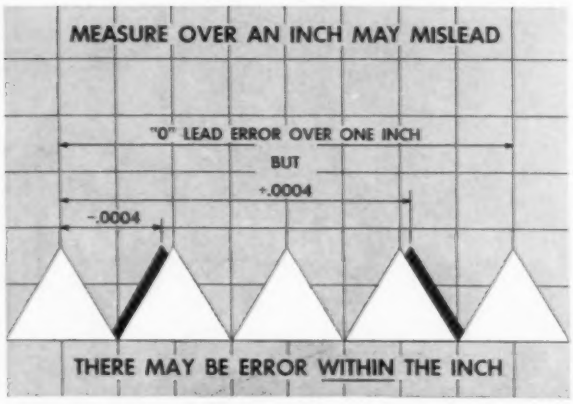
Copper and Brass Sales, Inc., Detroit, Michigan
A. R. Purdy Co., Inc., Lyndhurst, New Jersey
Fullerton Steel and Wire Co., Chicago, Illinois
Hubbell Metals Inc., St. Louis, Missouri
Reliance Magnesium Company, Los Angeles, California
Vinson Steel and Aluminum Company, Dallas, Texas

YOU CAN DEPEND ON DOW









Typical illustrations from new SPS booklet show effect of lead error on PD tolerance, explain why plus and minus errors do not cancel and why lead error is not necessarily progressive.

Lead error: what it is; how to detect it—new SPS booklet tells all

A lead error of only .002 in. within length of thread engagement increases the effective diameter of a Class 3A ½-20 screw so that it will not go into its tapped hole. Smaller errors in lead—say .001 or .0005—can play equal havoc with the smaller diameter screw threads. Lead error accounts for over 50% of today's thread assembly problems, causing rejects, production delays, and excessive wear on power wrenching tools.

SPS has prepared a new booklet on this important but little-understood subject that should be helpful to anyone making, buying or using threaded fasteners. It explains the anatomy of lead error, its mathematics, its common causes, and the means for detecting and preventing it. Exposed are such fallacies as the theory that plus and minus lead errors cancel (they add) or that most lead error is progressive (it's mainly erratic).

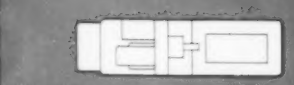
All SPS UNBRAKO socket screw products are made to a true Class 3A fit with precisely controlled lead. Complete stocks are carried by industrial distributors. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

Form 2294: "A New Look at Lead Error—Thread Tolerance Thief No. 1." 16 pages with many illustrations. Write for free copy today.

We also manufacture precision titanium fasteners—write for free booklet

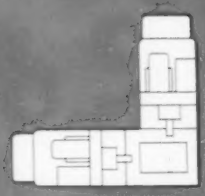
SPS Jenkintown • Pennsylvania

Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Columbia Steel Equipment Co., Inc. • Nutt-Shel Corporation • SPS Western • Standco Canada Ltd. • Unbrako Socket Screw Co., Ltd.

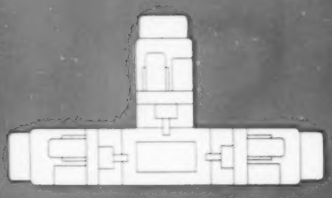


ONE WAY

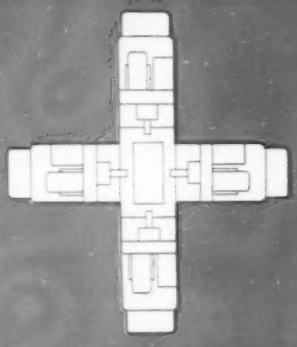
TWO WAYS AT 180°



TWO WAYS AT 90°

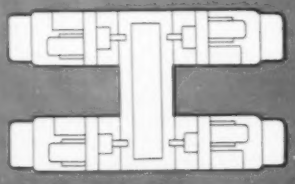


THREE WAYS



FOUR WAYS

MULTI-WAYS



MULTI-WAYS

Ex-Cell-O 4-Way Machine precision bores four holes simultaneously, holding 90° angles.

7 ways to increase your production

Three new features on all Ex-Cell-O Way Machines give even greater production and precision

The diagrams at left tell a story.

Ex-Cell-O Way Machines using standard components in the combinations illustrated perform precision boring, turning, facing, grooving and chamfering operations economically and quickly. They take large work pieces in stride—the spindles move to the work.

In each machine three new features assure long life, dependable operation, and exceptional accuracy.

The features: (1) ways are hardened and ground, (2) slides are fully supported the length of the stroke, (3) hydraulic control panels give a wide range of automatic cycles.

Write Ex-Cell-O in Detroit for further information. Better still, call in an Ex-Cell-O representative.

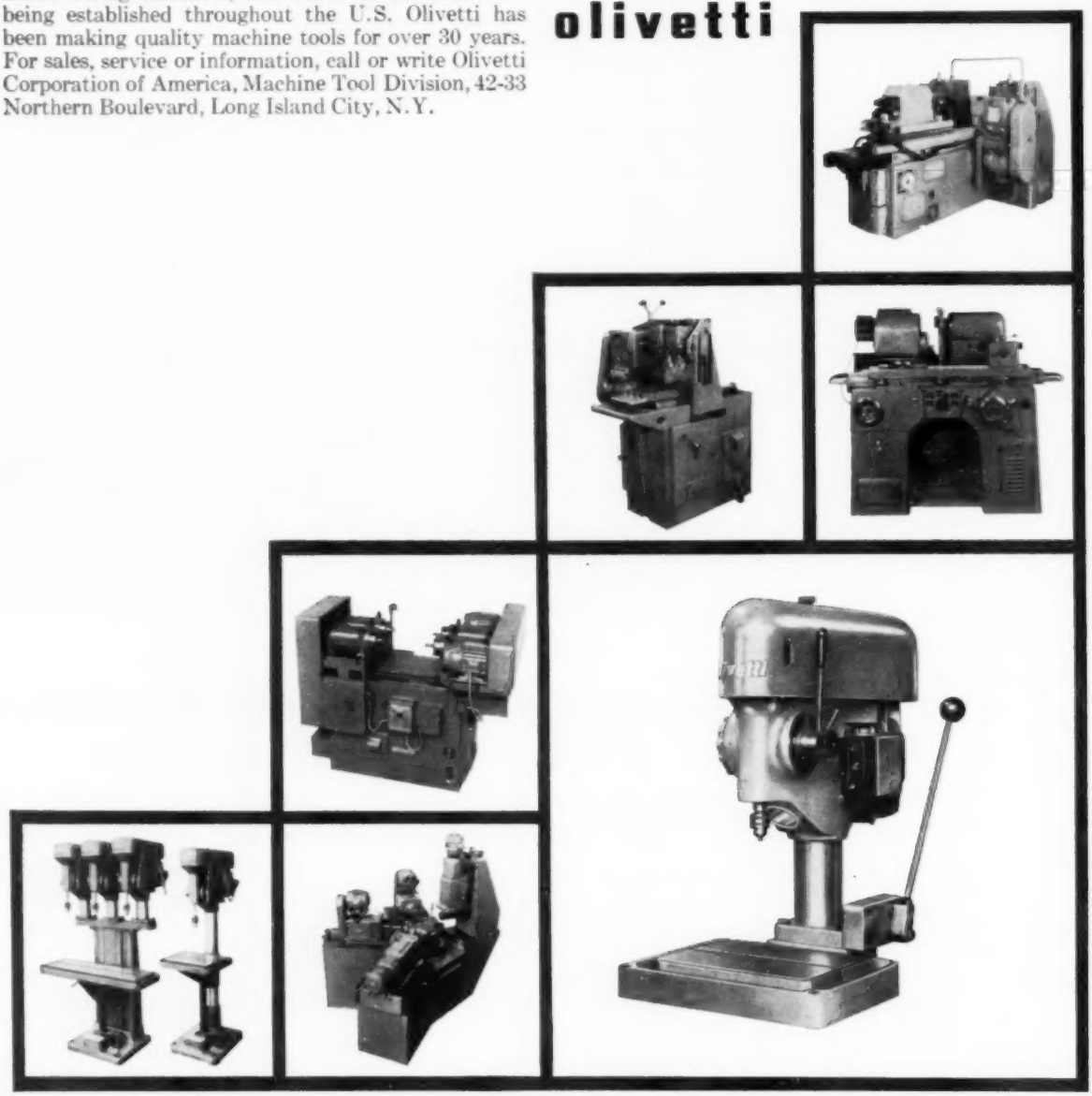
EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-44

National distribution of Olivetti sensitive drill presses, cylindrical grinders, production milling machines, automatic boring machines, and units for automation is being established throughout the U.S. Olivetti has been making quality machine tools for over 30 years. For sales, service or information, call or write Olivetti Corporation of America, Machine Tool Division, 42-33 Northern Boulevard, Long Island City, N.Y.

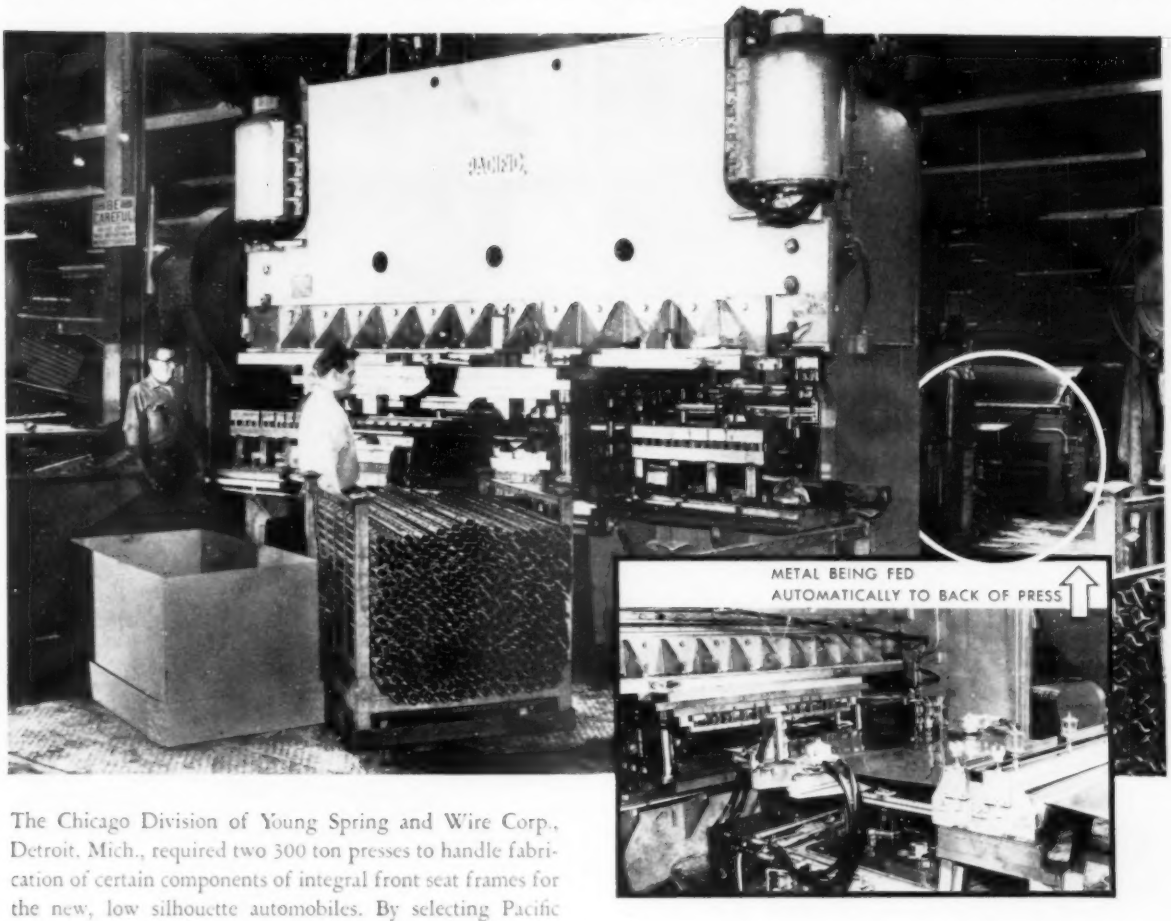
olivetti



SOME FEATURES OF OLIVETTI DRILL PRESSES
Hydraulic head or table raising/ precision spindle/ flat belt drive for minimum vibration/ solidly built (T6-b weighs 176 lbs.)/ extra-sensitive adjustable spring return feed lever/ work light (extra) built into head/ powerful (T6 has a ¾ H.P. motor).

Model T6-b (shown above) has 7/32" capacity, 8 speeds up to 12,000 r.p.m. Other models: T12, 15/32" capacity; T18, 11/16" capacity.

Hydraulic press brake reduces machinery and operational costs for forming large, heavy metal stampings



The Chicago Division of Young Spring and Wire Corp., Detroit, Mich., required two 300 ton presses to handle fabrication of certain components of integral front seat frames for the new, low silhouette automobiles. By selecting Pacific Hydraulic Brakes and using progressive dies coupled with an automatic material feeding system, it became possible to form major components of seat frames at each stroke of press. In a one-man operation, the first press stamps and forms the rear rail . . . the major component of the seat frame . . . from 57½" width material automatically fed through a 9-station progressive die from the back of the press to the front. The second press with two 4-station dies flattens and forms the ends of tubular material used for front seat, split-backs. Hydraulic system holds ram momentarily at the work to distribute tonnage evenly as punches enter material. Pressings are noiseless and extremely accurate.

Pacific Hydraulic Brakes actually cost less than conventional presses for this work. Pacific is a versatile tool profitable for any plant, large or small. It pays for itself from operational savings in blanking, forming, deep drawing, embossing, punching, straightening, stretching, extruding, hot forming or shearing. There is a Pacific Hydraulic Press Brake of the correct size to suit your needs.

Write for brochure

PACIFIC INDUSTRIAL MANUFACTURING COMPANY

PACIFIC
HYDRAULIC BRAKE

848 49th AVE., OAKLAND, CALIF.
PLANTS:
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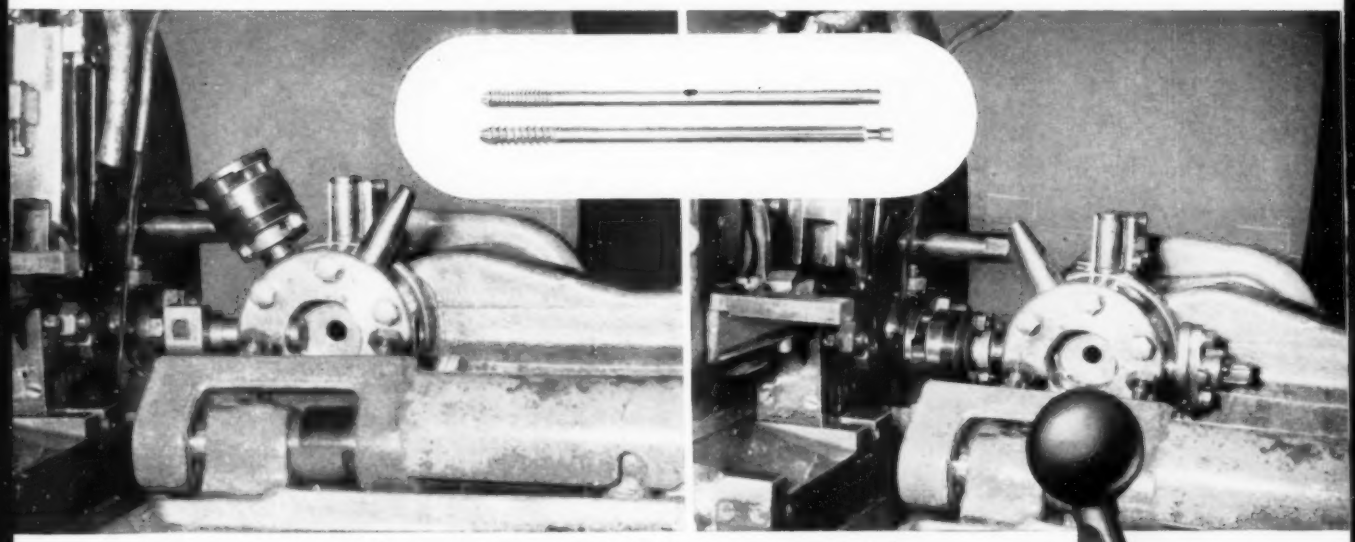
Westinghouse adds new productive capacity to present metal turning equipment

and eliminates costly secondary machining operation



In this setup, on a Brown & Sharpe automatic, down time was reduced to a minimum, due to the fact that it was possible to thread more than 500,000 pieces before it was necessary to reverse the rolls—a distinctive Acme-Fette feature which doubles the life of threading rolls.

ROLLS THREADS . . . faster and better

WITH NEW ROTATING — NON-ROTATING

Acme-FETTE

THREAD ROLLING HEAD AND ROLLS

With an Acme-Fette THREAD ROLLING HEAD in the primary setup, Westinghouse completed these electric appliance terminals without a secondary machining operation. Time saved in rehandling alone more than equalled the cost of the head and rolls.

Acme-Fette Thread Rolling Heads are available in 8 sizes, in capacities from $\frac{1}{16}$" to 2", at only a fraction of the cost of specialized equipment. The same head can be used in both rotating and non-rotating spindle machines—either horizontal or vertical.

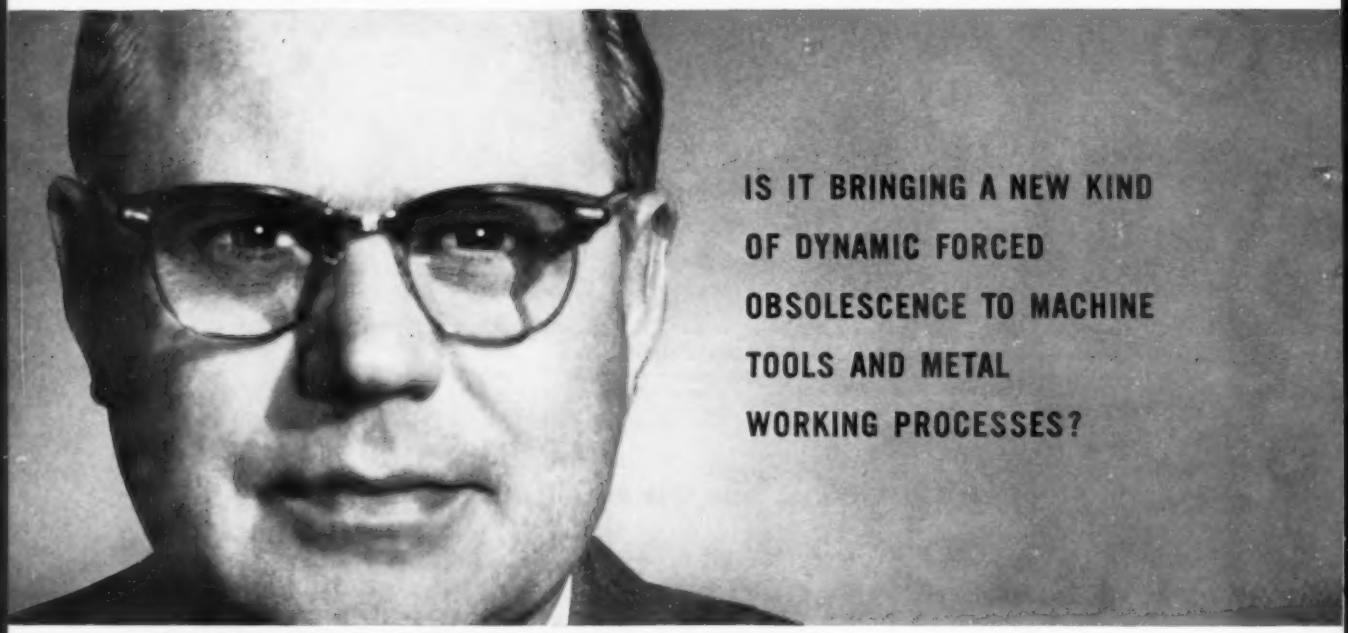
For cost-reducing ideas showing how you can combine thread rolling operations on your present equipment, send for Catalog NAF-57.

- Makes threading from the end now possible on any rotating or non-rotating spindles.
- Rolls threads up to 5 times faster than—and without chip problems associated with—thread cutting.
- Provides smoother threads, of consistently closer tolerance, with greater tensile strength—and without cratering at the thread crest.

National Acme

THE NATIONAL ACME COMPANY, 184 E. 131ST ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

The bright new era belongs to those who



C. R. DE VLIEG, Executive Vice President, DeVlieg Machine Company.

Here at Fair Street, we think that the answer unquestionably is "yes."

We have felt it already, as you must have, too, in your business. The evidence is everywhere indicating that we are racing into the greatest industrial revolution of all time. We are backing our own conviction with the dollars it takes to build the new highly efficient plant you see pictured here.

Technological progress of the last 10 years more than equals any previous 50 years in the history of mankind.

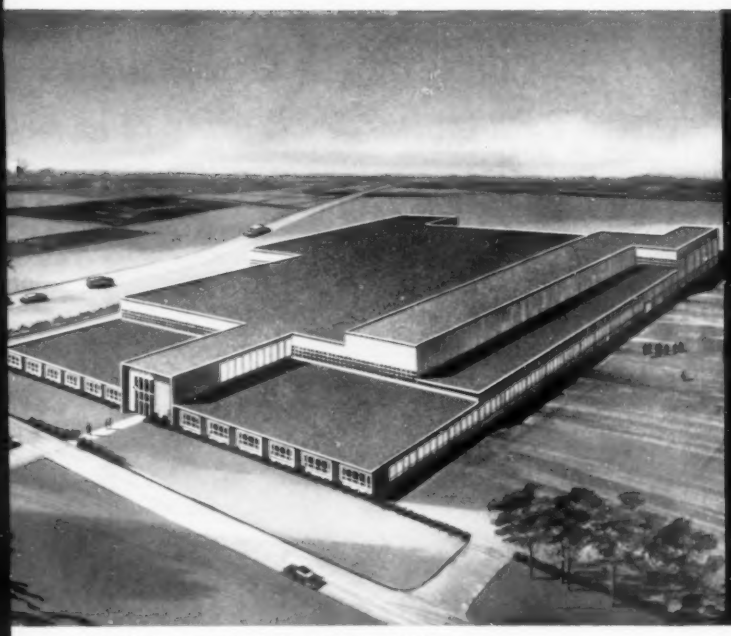
And still, relentless research goes on. One breakthrough into new areas of science and engineering is quickly followed by another. New materials, new methods, new processes, higher accuracy control and most significant of all, *vast product changes affecting every business are in the making.*

From it all is emerging what virtually amounts to a new philosophy in running a metalworking business. The basic tenets now are clear to those who expect to control their own destiny in the bright new, bitterly competitive era ahead.

The old "needs" now are becoming "musts." Greater flexibility in design and production to meet competitive product changes can no longer be ignored. The need for shorter time cycles and lower inventories is imperative. Already, old established theories of obsolescence are being knocked into a cocked hat. And the time is fast approaching when no shop can afford costly boring jigs and fixtures or the intolerable months of lead time required to manufacture them.

DE VLIEG MACHINE COMPANY, 450 FAIR STREET

plan for it . . .



New 130,000 sq. ft. Jigmil plant to be completed in June.

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Now while you and we have a breather period, will you come, too? Come simply to watch. The Jigmil does the selling. And we promise answers that will pay off handsomely for you—*proved in advance*. A Deferred Payment Plan is available, if desired.

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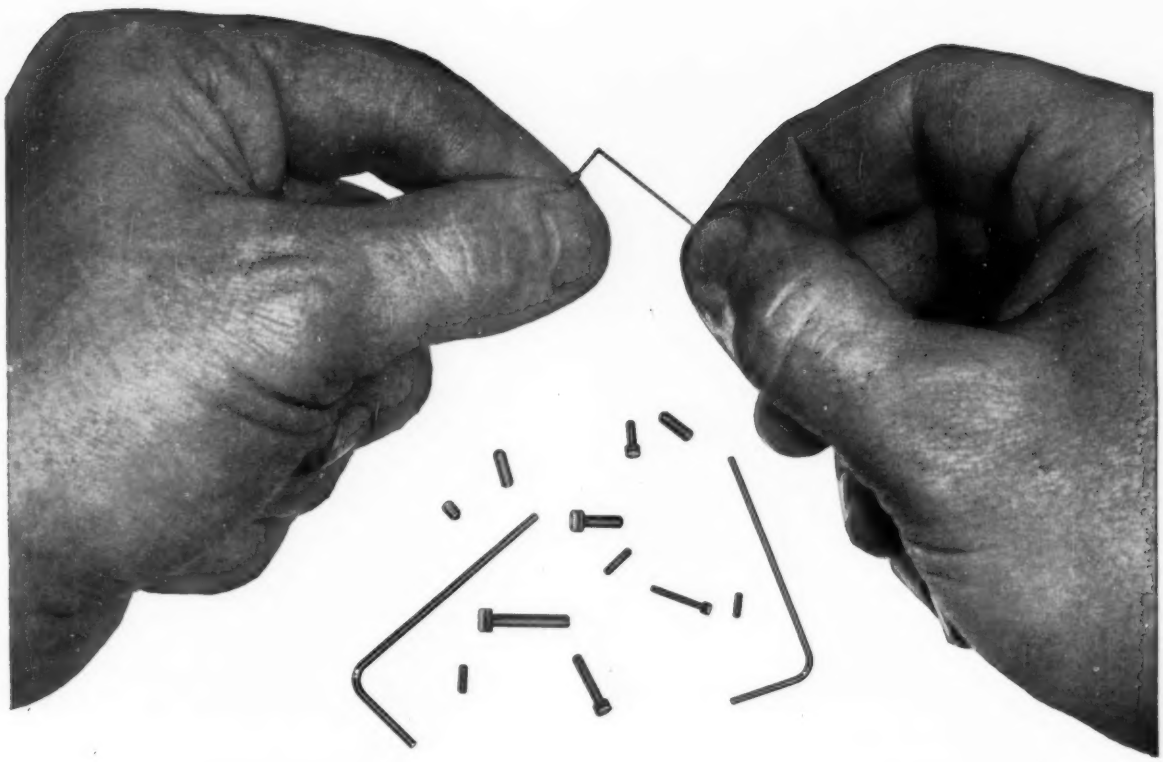

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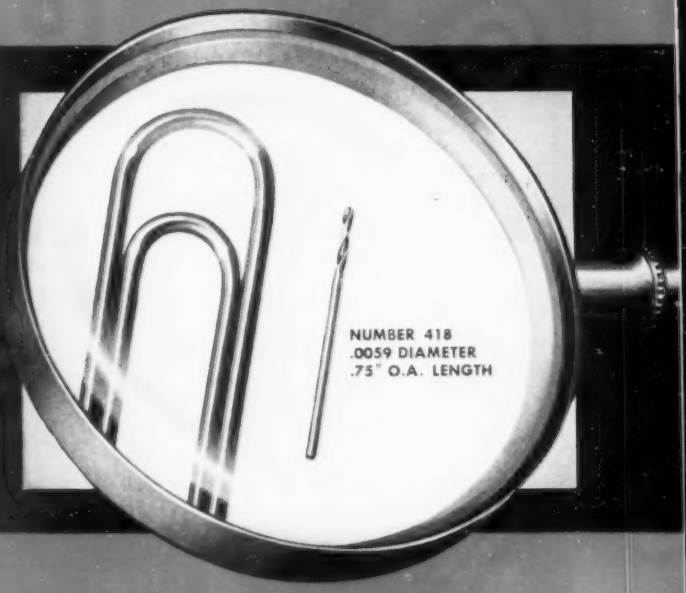

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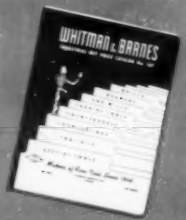

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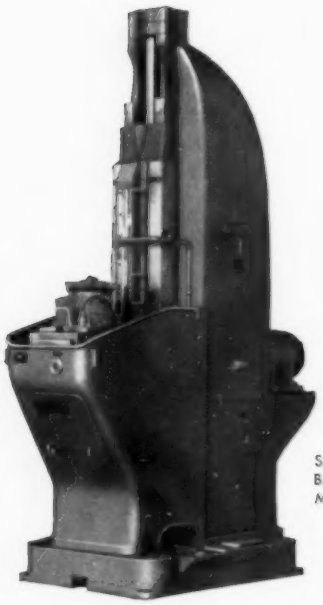

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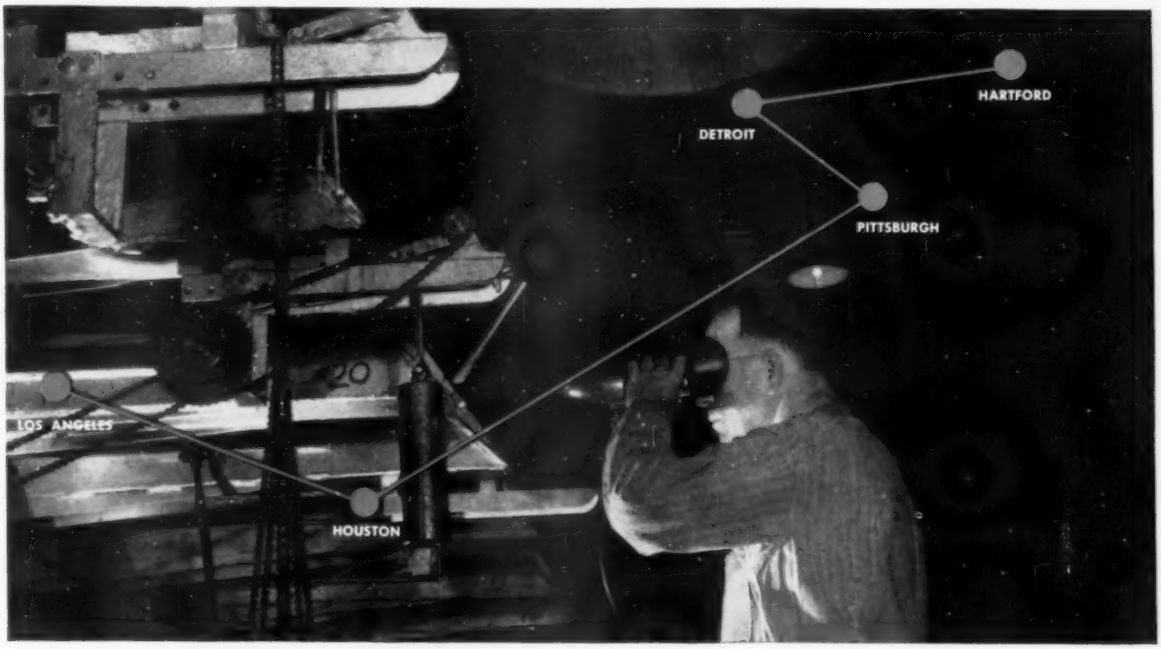

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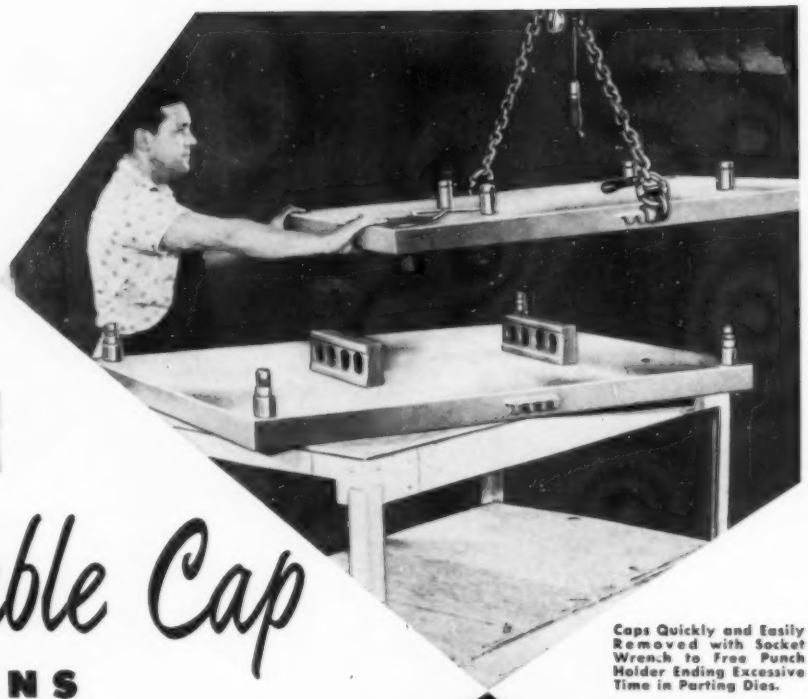

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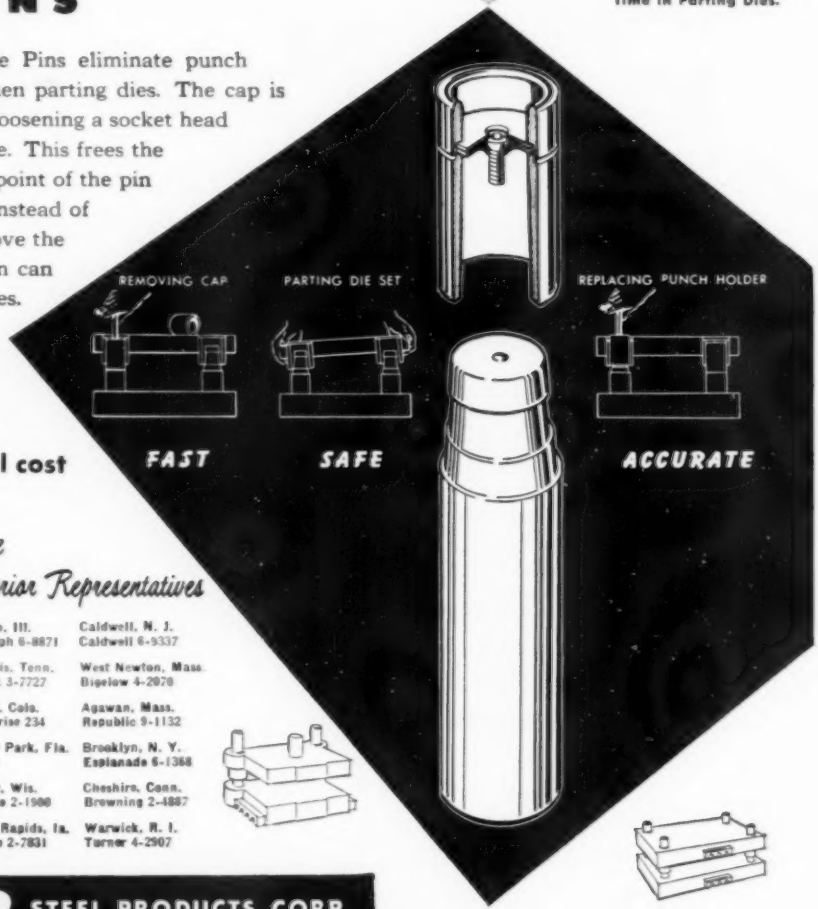

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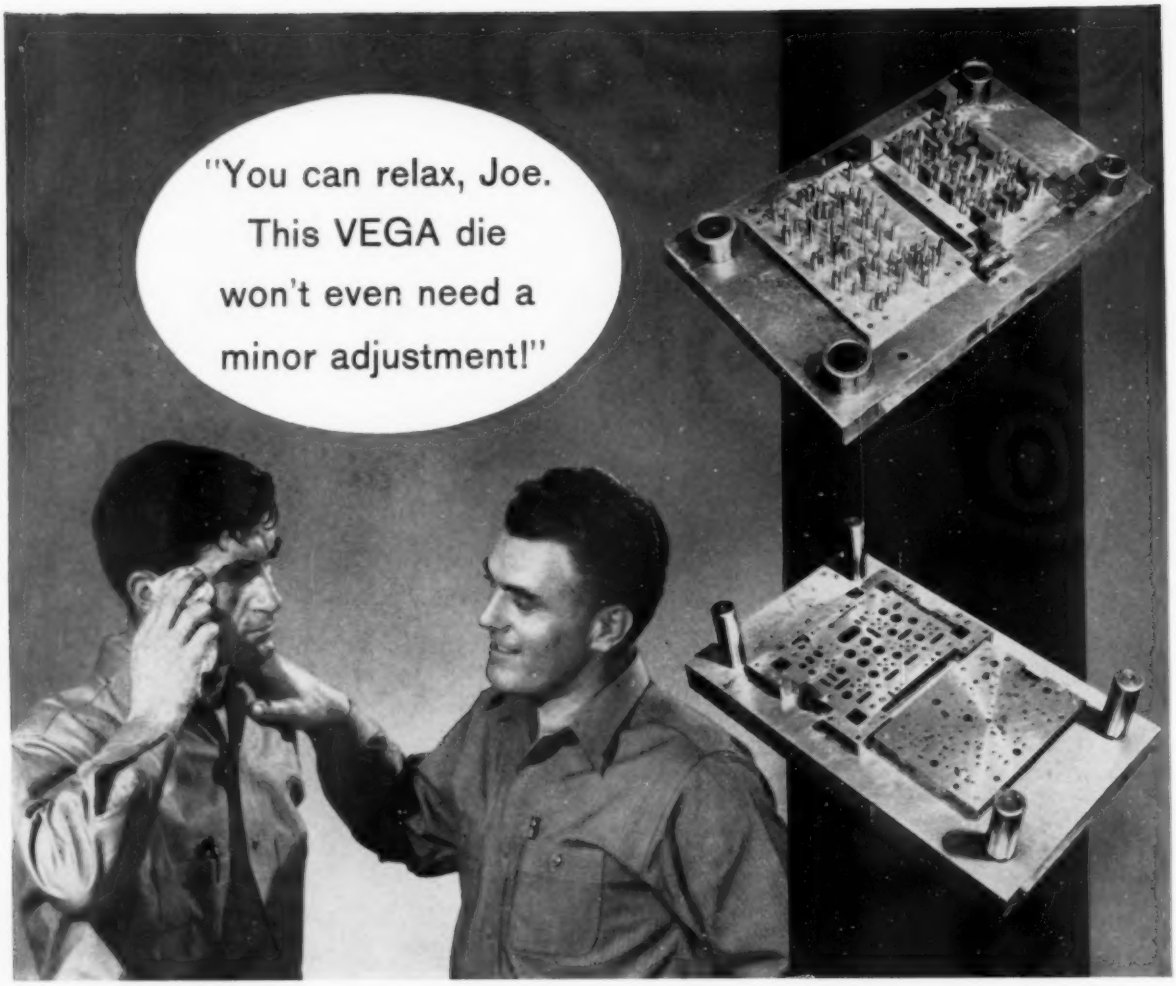

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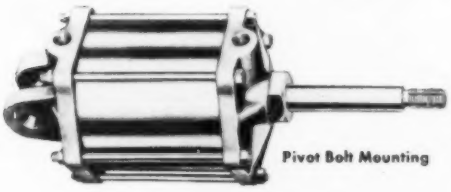
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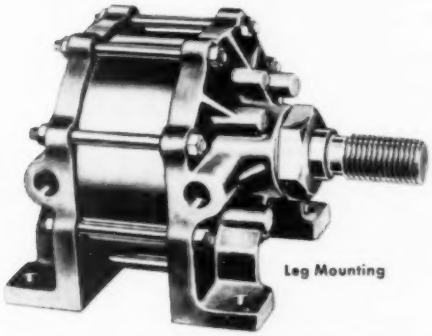
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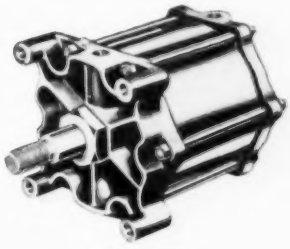
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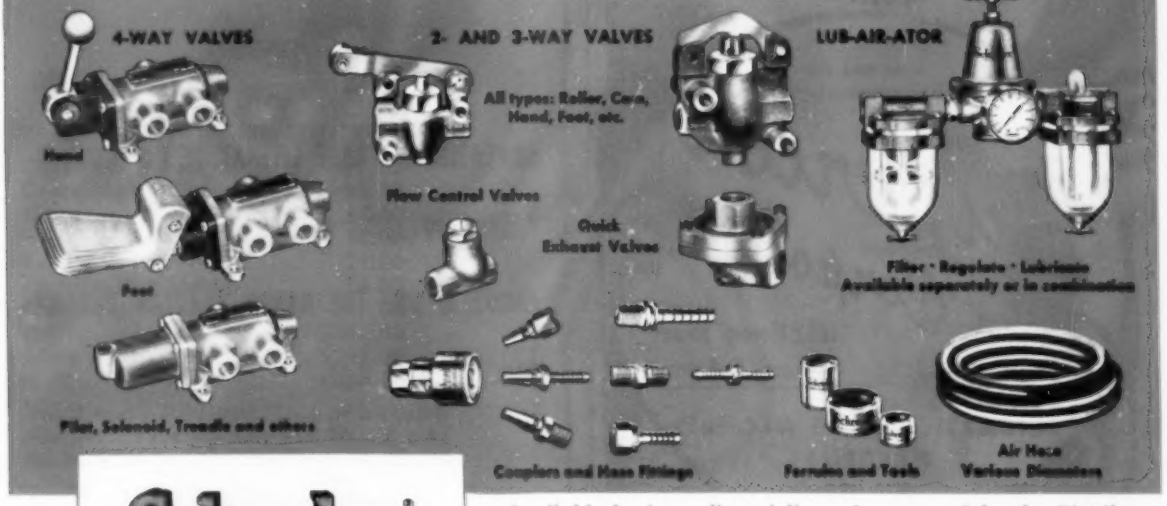

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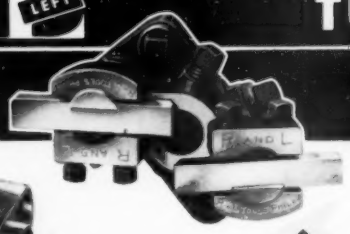
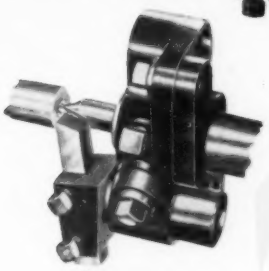


The R and L Turning Tool can be changed from right to left in 10 seconds, and vice versa . . . It is guaranteed not to bend or give way in any manner.



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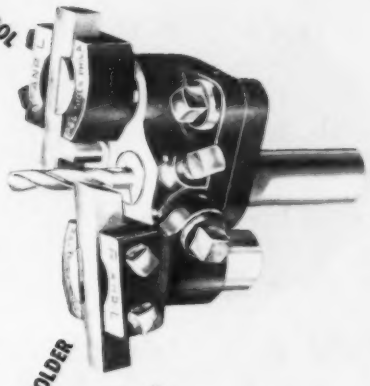
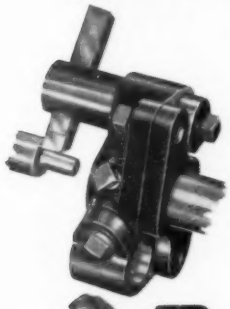
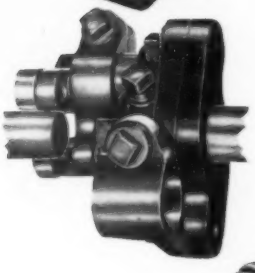


R and L Turning Tool used as CENTERING & FACING TOOL



R and L Turning Tool used as KNEE TOOL

R and L Turning Tool used as BACK REST



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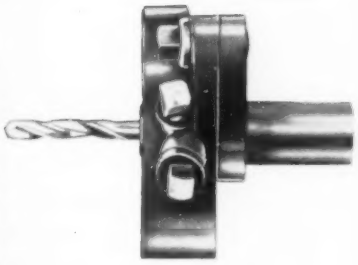

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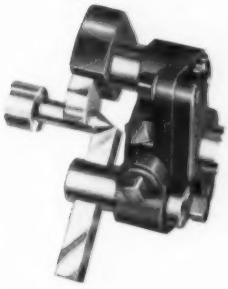

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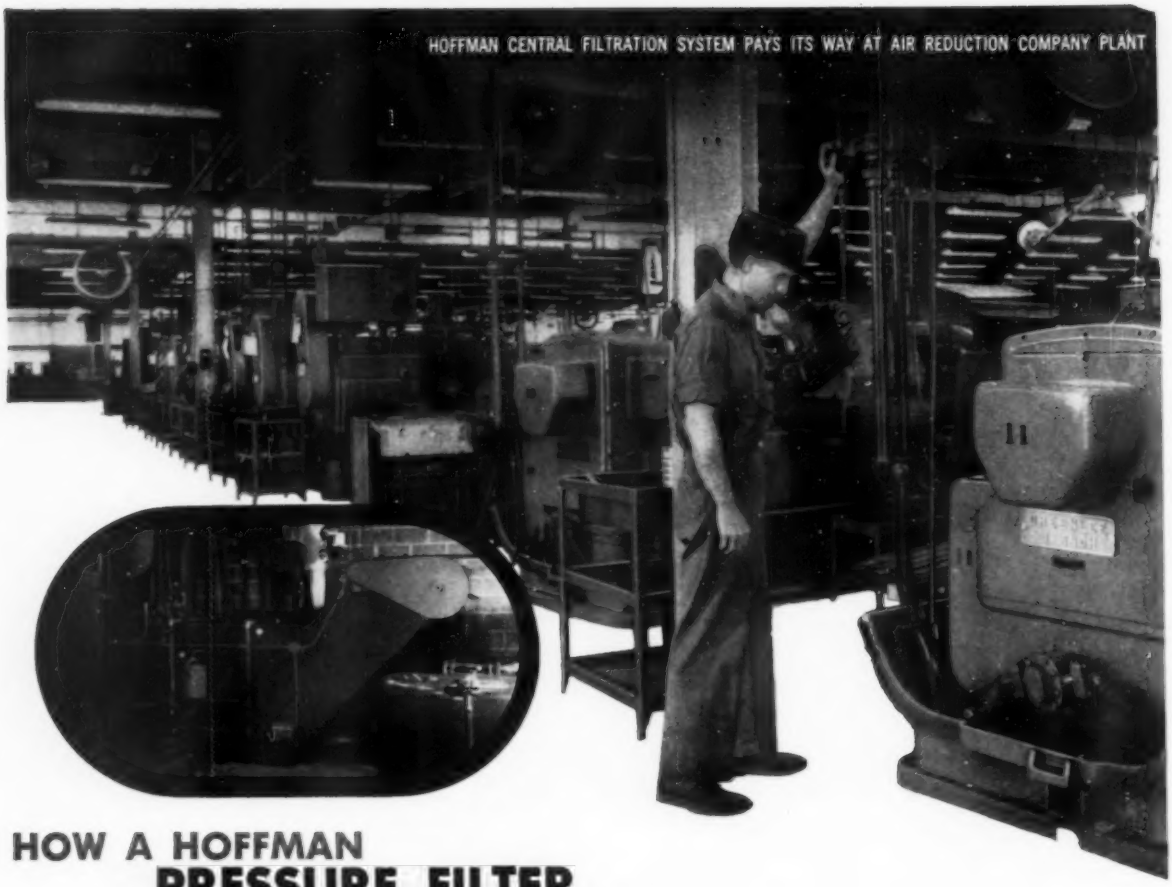
RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.



HOW A HOFFMAN PRESSURE FILTER REDUCED DOWN TIME AND CUT WELDING EQUIPMENT MANUFACTURING COSTS

before ⟵ ⟶ **after**

the installation of a U. S. Hoffman Central coolant system servicing 30 **AUTOMATIC SCREW MACHINES,** these were among filtration problems at the Equipment Mfg. Plant of the Air Reduction Co.

1 — Each of the frequent machine changeovers with complete sump clean up required one hour.

2 — With each changeover, cutting and lubricating oil was completely discarded.

3 — Down time reduced production.

4 — Cost of servicing and maintaining machines and equipment was high.

Hoffman centralized coolant filtration was installed, these time, labor, and money saving accomplishments were noted:

1 — Changeover time and complete sump clean up has been reduced to twenty minutes.

2 — During each changeover, 80 to 90 gallons of oil is removed by ejector and recovered.

3 — Reduced down time increased production.

4 — Savings in maintenance and oil recovery rapidly paid for cost of equipment.

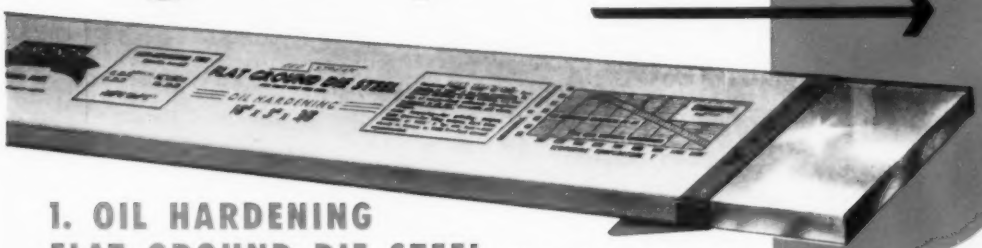
HOFFMAN FILTRATION SYSTEMS *custom engineered for your needs*

Ask your Hoffman representative to analyze your filtration problems or write for Bulletin FB100 for further information.

INDUSTRIAL FILTRATION DIVISION U.S.HOFFMAN MACHINERY CORPORATION 103 FOURTH AVENUE, NEW YORK 3, N. Y.

Other industrial equipment—by Hoffman: **AIR APPLIANCE DIVISION,** Multistage Centrifugal Blowers & Exhausters—Industrial Vacuum Cleaning, Portable and Stationary Systems—**PNEUMATIC CONVEYING DIVISION**—Custom Built Systems.

SIMONDS
gives you all 3



1. OIL HARDENING FLAT GROUND DIE STEEL

Simonds quality-controlled tool steel . . . precision ground . . . ready-to-use . . . comes in 1001 stock sizes for 1001 uses: punches, dies, machine parts, small tools, etc. Spheroidize-annealed for best machinability. Wide hardening range. Oil quench 18" and 36" lengths . . . flats and squares . . . individually packaged. *Chemical Analysis:* C .85-.95, Si .20-.35, Mn 1.30-1.50, Mo .20-.30

2. AIR HARDENING FLAT GROUND DIE STEEL

This 5% chrome, spheroidize-annealed tool steel has exceptional wear-resistant qualities yet is easy to machine and heat treat. Ground to accurate dimensions . . . suitable for a multiplicity of uses . . . individually packaged in a wide range of stock sizes . . . flats and squares . . . standard 36" lengths (18" lengths also furnished, if desired). *Chemical Analysis:* C .95-1.05, Cr 5.00-5.50, Si .30-.50, Mn .50-.70, Mo .90-1.10, V .20-.30

3. and the NEW LOW CARBON FLAT GROUND STEEL

Here's a fine-grained, forging quality, silicon-killed steel that offers important savings on jigs, fixtures, patterns, stripper plates, punch pads, die plates, die-blocking shims . . . and parts that don't require heat treatment, or in some cases just case-hardening. This new line of low-cost steel rounds out the Simonds line of Flat Ground Steel, has equally fine finish, with excellent welding quality and machinability. Furnished in a wide range of flats from 1/16" to 1 1/2" thick and 1/2" to 16" wide, and in squares from 3/8" to 2 7/8". All sizes come in standard, ready-to-use 24" lengths, individually packaged. *Typical Chemical Analysis:* C .18, Mn .50, Si .20, S .04, P .04

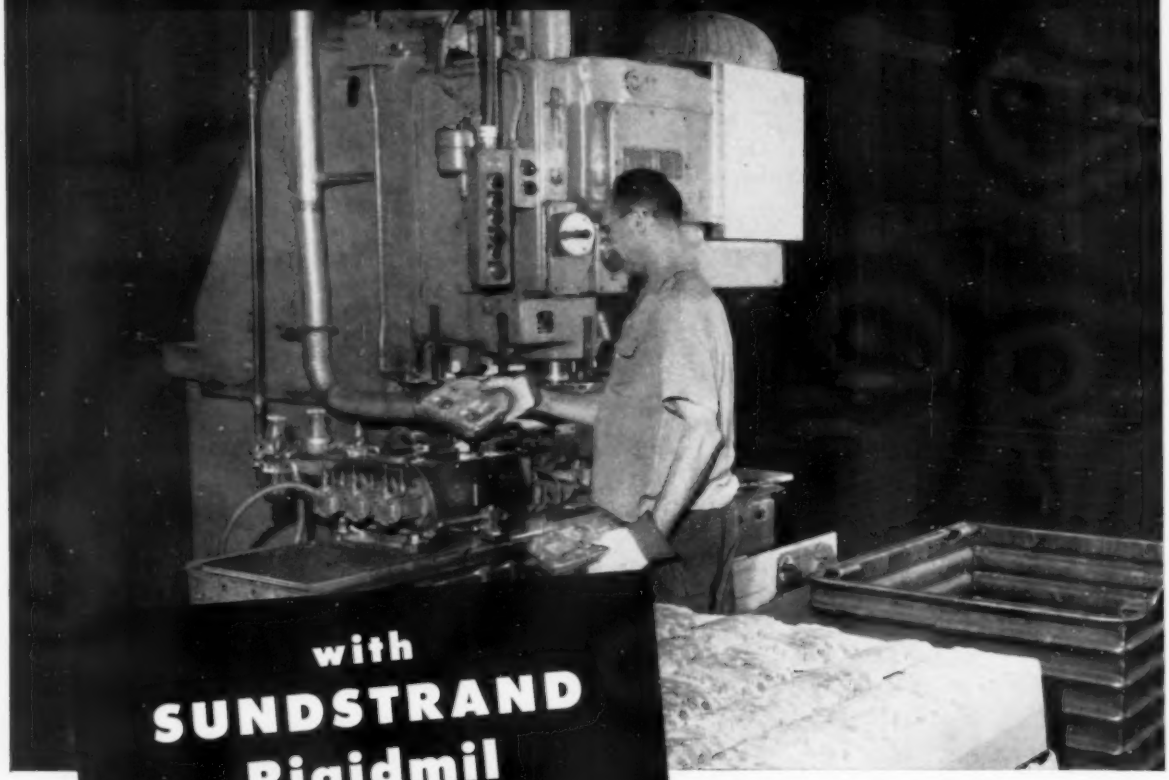
GET FULL DETAILS
PROMPT DELIVERY OF
ALL 3 TYPES
FROM YOUR SIMONDS DISTRIBUTOR

For Fast Service
from
Complete Stocks
Call your
SIMONDS
Industrial Supply
DISTRIBUTOR

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, Shreveport, La., San Francisco and Portland, Oregon
Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.
Heller Tool Co., Newcomerstown, Ohio
Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

MILLING PRODUCTION TRIPLED



with SUNDSTRAND Rigidmil

A production jump from 365 to 1125 cylinder heads per eight-hour shift is the record set by this Sundstrand Vertical Rigidmil in the plant of a major builder of heavy duty air cooled engines. Not only was this sizable production increase effected by the change from former method of machining, but also the size tolerance is being held within .0002 inch during the face milling operation. Fixturing includes two workholders with hydraulic clamping permitting one station to be unloaded and loaded while the other is in milling position.

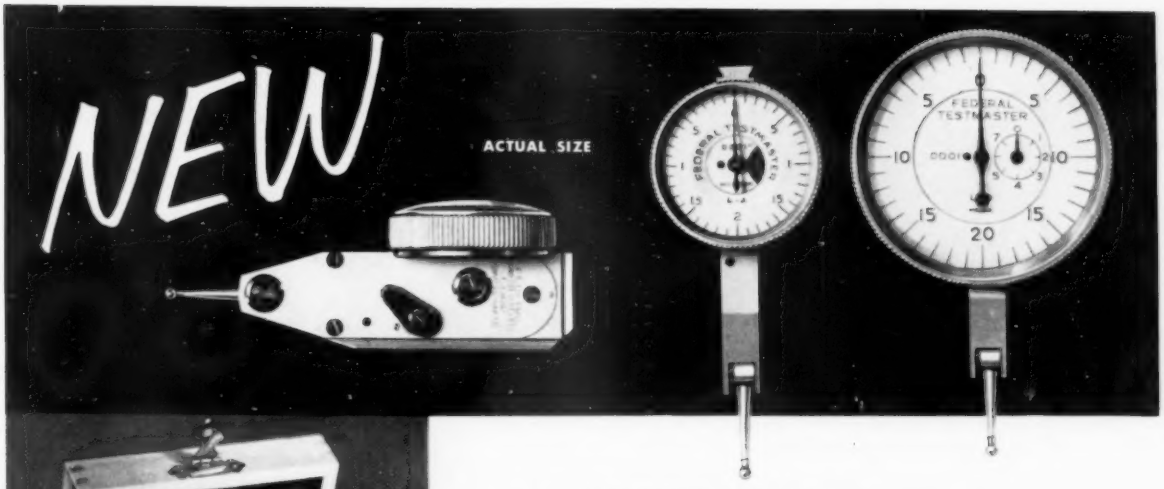
Performance like this is what you get by combining Sundstrand "Engineered Production" Service with advanced designs of standard, semi-standard, and special machines. Sundstrand's record of proved performance in hundreds of automotive, aircraft, farm equipment, railroad, and construction equipment plants insures that you'll get the most practical machining methods for your needs.

Write for Bulletin 788 describing C-Model Rigidmils, the newest development in production milling from Sundstrand.

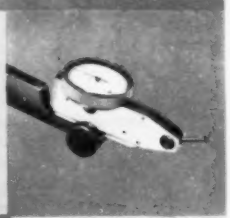
SUNDSTRAND
Machine Tool Co.
2540 Eleventh St. • Rockford, Ill., U. S. A.

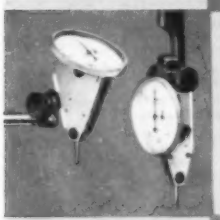
SUNDSTRAND "Engineered Production" Service

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS | TRIPLEX RIGIDMILS | SPECIAL MACHINES



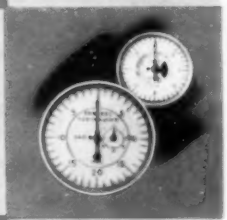
INTEGRAL DOVETAILS make mounting more versatile and secure (An exclusive Federal feature).

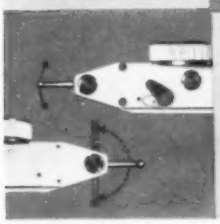




LARGE DIAL MODELS also available in both horizontal and perpendicular styles.

EASY-TO-READ PRECISION DIALS . . . crisp, clear-cut graduations.





CLUTCH-MOUNTED CONTACT (180° rotation) and easy-to-use REVERSING LEVER.

The long range, high magnification

FEDERAL TESTMASTER

8 new models SWISS MADE to the highest FEDERAL Standards

Now, the most imitated test indicator of all time . . . the Federal Testmaster, adds eight new models to its Series, all made to the highest Federal standards by Swiss craftsmen and all immediately available. These new models, too, will be imitated but never equaled. Beware of look-alikes and imitations.

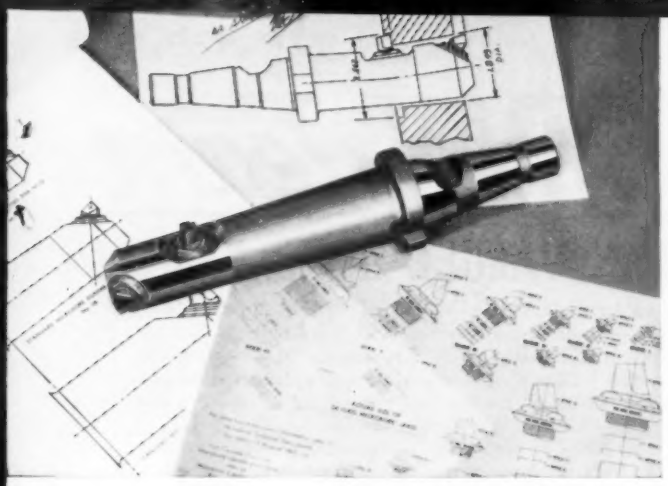
- These new Federal (Series L) Testmasters have up to *four times the range* you'd expect in a test indicator. The four models with .0005" graduations have .060" range. The other four models (.0001" graduations) have .032" range.
- Despite this longer range, the new .0001" Models have at least *twice the magnification* of other type test indicators. Range per revolution is .004".
- *Even greater magnification* (50% more) if you select the large dial models in this new Testmaster series. They are available in .0001" and .0005" graduations and in regular or perpendicular styles (as are the more compact, smaller dial models).
- Many other features . . . integral dovetails for convenient and positive mounting . . . easy-to-use reversing lever . . . clutch-mounted, interchangeable contact . . . velvet-smooth operation . . . BALL BEARING PIVOTS for low-friction, truly accurate motion transfer.

FOR THE WHOLE STORY ON THESE NEW FEDERAL TESTMASTERS ASK FOR BROCHURE.

FEDERAL PRODUCTS CORPORATION
8192 Eddy Street, Providence 1, R. I.

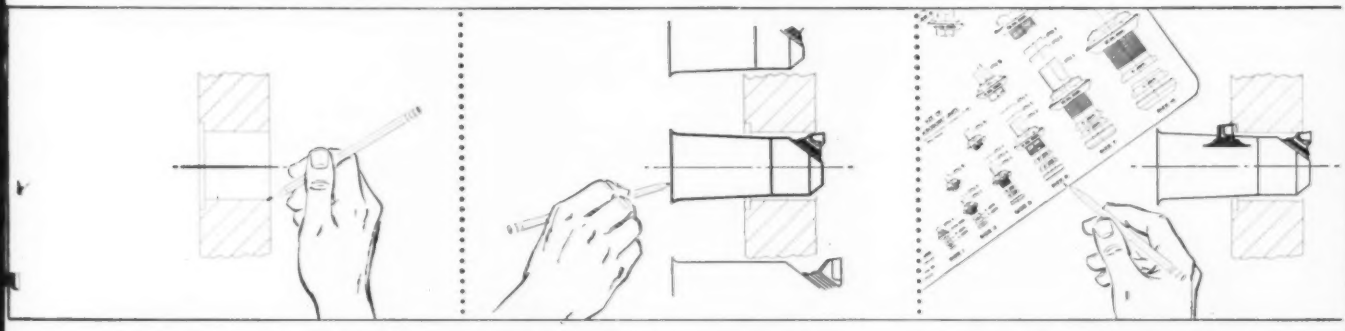
Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .
Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging



now, design your own semi-standard cluster tooling from stock Microbore components

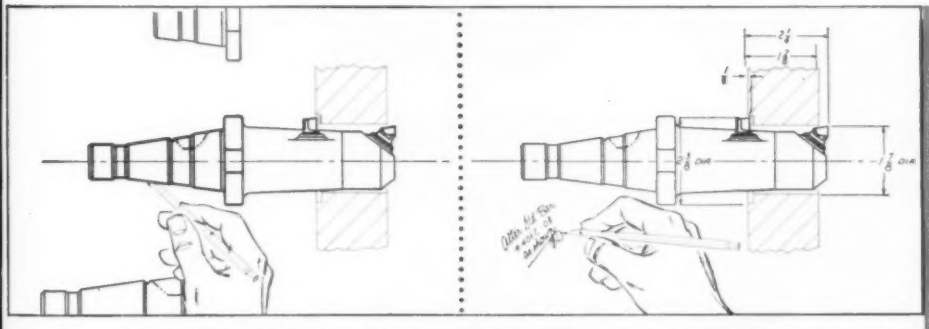
SIMPLE 5-STEP PROCEDURE



1 Make a full scale layout of bore to be produced, on tracing paper.

2 Place layout over standard bar nose templates. Select and trace the most suitable bar nose.

3 Select suitable Microbore Unit from template and trace in position for added tool station.



4 Trace the desired shank on boring bar, using shank template.

5 Microbore tool stations will be added to the standard Microbore Boring Bar as specified.

Simple cluster tooling designed in this manner costs little more than standard bars; substantially reduces delivery time, and is thus ideally suited for low-production applications.

NEW "TOOL DESIGNERS LAYOUT KIT" MAKES IT POSSIBLE!

Using transparent, full-size templates and a price index, it is now possible to design, pre-price and order your own semi-standard cluster tooling from stock Microbore components.

Any one of the several hundred standard Microbore Boring Bars may be converted into two- or three-tool cluster bars for such operations as boring, facing, counterboring and chamfering at one pass.

DeVlieg® Microbore® System

DEVLIEG MICROBORE • DIVISION OF DEVLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

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DIVISION OF DEVLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd.
Royal Oak, Michigan

MAIL TODAY!

- ☐ I would like further information on the Microbore "Design Kit."
- ☐ I would like a dealer demonstration of the design technique.

NAME

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NAME OF COMPANY

New NOPAK *Team*

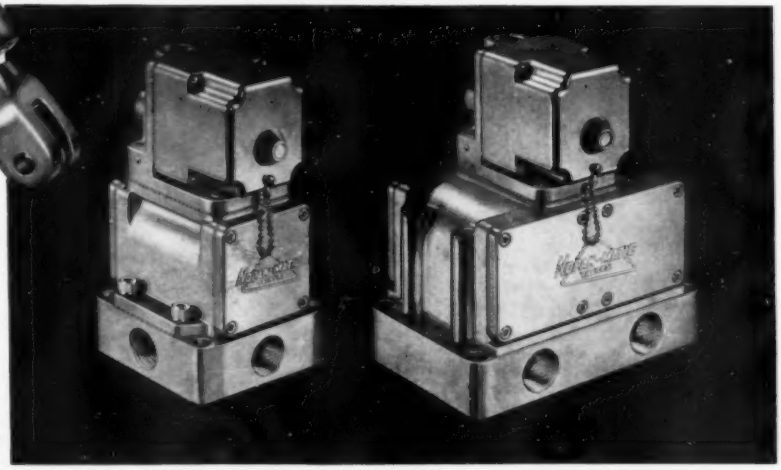
delivers PLUS VALUES in Air Power!

NOPAK Air Cylinders, long known for their dependability and economy, now can be applied to even greater advantage with the new Nopak-matic pilot operated air control valves. Full flow design and dependable performance make NOPAK Cylinders and Nopak-matic control valves the perfect "team" for "in plant" or O.E.M. applications. They deliver Plus Values that you can measure in terms of greater speed, higher efficiency, easier maintenance, a wider range of adaptability and versatility.

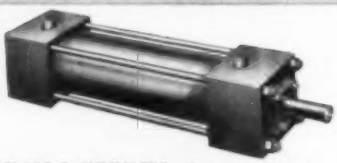
• NOPAK Class 1 and 2 Cylinders are available in 7 standard mountings in bore sizes from 1½" to 14" with a choice of non-cushioned, self-regulating or adjustable cushioned heads on all models.

• Nopak-matic, Pilot-operated, Poppet-type Air Control Valves are available in ¼", ⅜", ½" and ¾" pipe sizes for 2- or 3-Way normally open or normally closed operation, and 4-Way operation with master (air), single or double solenoid control heads. All 4-Way valves available, as standard, with choice of side or bottom ported sub-plates. Air pressures to 150 p.s.i.

Catalog 101-A and Catalog 105 provide complete descriptive and engineering data.



Other NOPAK Products for your Fluid Power Needs



• **CLASS 3 CYLINDERS**—for pressures to 2000 p.s.i. Compact steel plate square head and tie-rod construction. Honed steel tubing. Heads may be cushioned or non-cushioned. Available in 14 standard mounting styles.

• **CLASS 4 CYLINDERS** — High Pressure Hydraulic — Heavy, honed steel tubing with lock-ring flange construction. For hydraulic (oil) service at line pressures to 3000 p.s.i. Choice of cushioned or non-cushioned heads. Available in 5 standard mounting styles.

• **CLASS M CYLINDERS** (Mill Type) Welded flange construction, with honed steel tubing, eliminates tie-rods. Recommended for all types of Heavy Duty air or hydraulic pressures up to 650 p.s.i. depending upon diameter.

The NOPAK line includes cylinders and valves for a wide range of fluid power application — and its precision control. In addition to standard air cylinders, there are heavy duty, mill-type cylinders, square head and lock-ring flange type hydraulic cylinders. The NOPAK Valve line includes the famous packless rotating disc valves in both hand and foot models, high pressure hydraulic valves, Flotrol speed control valves and reciprocating valves.

NOPAK 2- 3- AND 4-WAY HAND VALVES are used to control single or double-acting cylinders at air or hydraulic line pressures to 250 p.s.i. Precision lapped seal eliminates packing, prolongs valve life. Disc rotating at right angle to stream flow permits throttling action or immediate opening to full pipe area. Pipe sizes from ¼" to 2".

NOPAK 2- 3- AND 4-WAY FOOT VALVES incorporate all of the features of NOPAK hand operated disc-type valves including the lapped-disc design and packless construction. They are available in 3 types which are adaptable to a wide variety of control needs. Pipe sizes from ¼" to 1" for pressures to 125 p.s.i.

NOPAK FLOTROL SPEED CONTROL VALVES provide uniform control of cylinder speed in one direction, free flow in the other. Features: quick, easy, precision adjustment without tools; greater capacity; easy installation because of compact in-line design; fit in tight places; made of rust and corrosion proof materials. Pipe sizes from ¼" to 1".

Write for Catalog SW-3

NOPAK *VALVES and CYLINDERS*

GALLAND-HENNING NOPAK DIVISION • 2750 South 31st St. • Milwaukee 46, Wis.

A7-618-1P

Index of THE TOOL ENGINEER Advertisers

February 1958

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

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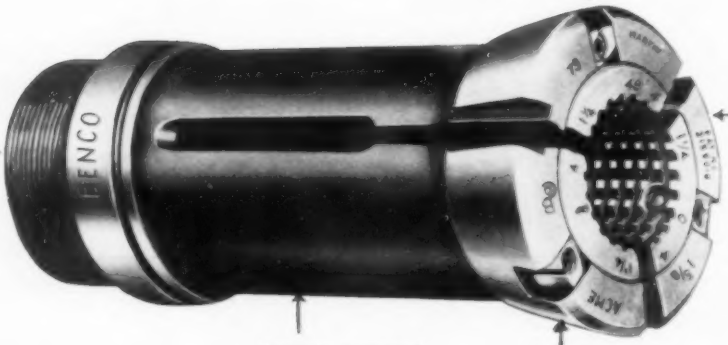
the exclusive combination of features in

BENCO MASTER COLLETS

adds up to longer and better service life



Besides working better and lasting longer, these Benco "Martin" Master Collets permit you to work to closer tolerances. Their accuracy is guaranteed to be less than .001 run-out per inch of bar extension from the collet face.

Even with all their features Benco Collets cost you no more than just ordinary collets. You get maximum performance . . . you save time and money by using them on all your automatics.

Most sizes of Solid and Master Pushers, Solid and Master Collets for all popular automatics will be delivered immediately from stock. Send for price list and catalog.

BENCO COLLET manufacturing company

Cleveland, Ohio

CTW

Continental Counterbores may be purchased individually or in sets. Selection of three sets available.

After the heaviest cuts– they disengage with a twist of the wrist

Continental Counterbores are designed so that cutting torque produces compression rather than shearing stresses. This counterbore never binds—you get quick, easy disengagement after all cutting operations. Anti-wedging action saves time and tools.

Continental Counterbores have double driving lugs on the cutters which engage double abutments in the holders, making a single powerful tool out of the cutter and holder. Double bearings, one above and one below the lugs and close to the cutting edge, guarantee rigid alignment of holder and cutter.

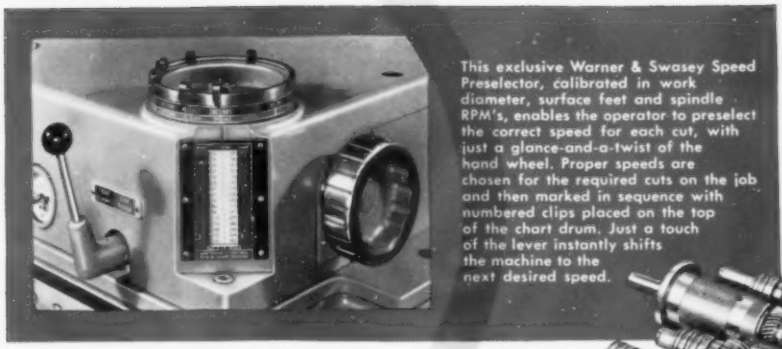
For more information or literature on Continental Counterbores, call your local Ex-Cell-O Representative or write to Continental Tool Works in Detroit.

Continental **TOOL WORKS**

DIVISION OF

EX-CELL-O CORPORATION • DETROIT 32, MICHIGAN

56-61



This exclusive Warner & Swasey Speed Preselector, calibrated in work diameter, surface feet and spindle RPM's, enables the operator to preselect the correct speed for each cut, with just a glance-and-a-twist of the hand wheel. Proper speeds are chosen for the required cuts on the job and then marked in sequence with numbered clips placed on the top of the chart drum. Just a touch of the lever instantly shifts the machine to the next desired speed.

instantaneous speed changes with the flip of a lever

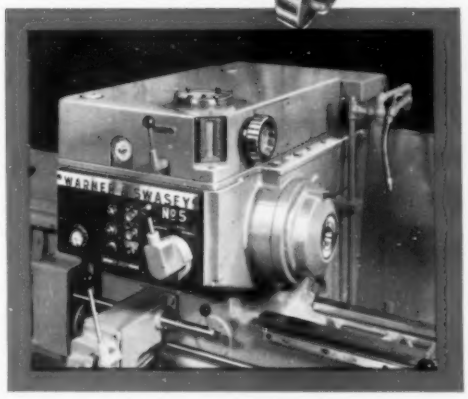
DIRECT-ACTING hydraulic clutches, with a constant-mesh gear train, eliminate all gear shifting on these new Warner & Swasey No. 4 and No. 5 Ram Type Turret Lathes. Clutches engage smoothly and quickly, providing fast starts, stops and reverses. Clutches never need adjustment.

With the patented speed preselector the operator can preselect speeds and with a mere flip of a lever, change speeds instantly.

A flip of the speed change lever in the opposite direction provides a valuable 6 to 1 speed reduction for threading or forming cuts—instantly and without preselection.

A total of 12 spindle speeds, or 24 unduplicated speeds with a two-speed motor, is available on these new machines. A touch of a button doubles or halves the speed, and when used in conjunction with the 6 to 1 speed change, four spindle speeds are instantly available with only one setting of the preselector.

A separate master lever controls forward, reverse, brake and neutral. *Zoned controls* on headstock and apron put them all within easy reach of the operator—cutting fatigue, speeding his work, putting more pieces on the floor every hour of every day!



WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY